AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 5, No. 47. WEEKLY. | NEW YORK, NOVEMBER 25, 1882. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

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The Cummer Automatic Engine.

We present on this and on page 3, engravings representing somewhat in detail the construction of the Cummer engine, as built by the Cummer Engine Company, of Detroit, Mich. This engine is of the type in which the speed is automatically controlled by varying the expansion, by means of independent expansion valves and a centrifugal disc, or wheel, governor.

Of the engravings, Fig. 1 represents a front and Fig. 2 a rear side view of the engine. Fig. 3 is a cross section through the girder frame, and a central section through the governor and its attached parts. From this it will be seen that the governor, instead, as is the more usual construction, of being mounted on the crank shaft, is arranged on a separate shaft, which is driven from the crank shaft by a train of three small spur gears. This shaft is hollow, and fitted with a centrally located rod, one end of which revolves in a step pivoted to the upper or vertical end of a bell-crank lever. The other end of this rod is so arranged that the rod will have a motion out or in, corresponding with the motion in either direction of the governor weights. In its motion outwardly it thrusts against the vertical end of the bell-crank lever. To the horizontal end of this lever, and to counteract the thrust of the rod, weights are attached. These weights are in amount sufficient to counteract the centrifugal effort of the governor weights when they are in their position nearest to the axis with the engine at regular speed. Since, however, as the distance of the weights from the axis increases, the centrifugal force similarly increases, the spring, as shown, proportioned so that the resistance will be, for all positions of the weights, and at substantially the same speeds, equal to the increased centrifugal effect due to the increased radius of the weights, is used.

By reference to Fig. 4, it will be seen that the free ends of the governor weights are, by means of a clamp collar and suitable rods, attached to the sleeve of the cut-off eccentric in such a way that the motion of the weights in either direction will roll the cut-off eccentric on the shaft in a corresponding direction, and by increasing or decreasing its angular advance, provide for cutting off steam at a point in the stroke required by the load, the steam pressure, and the required speed.

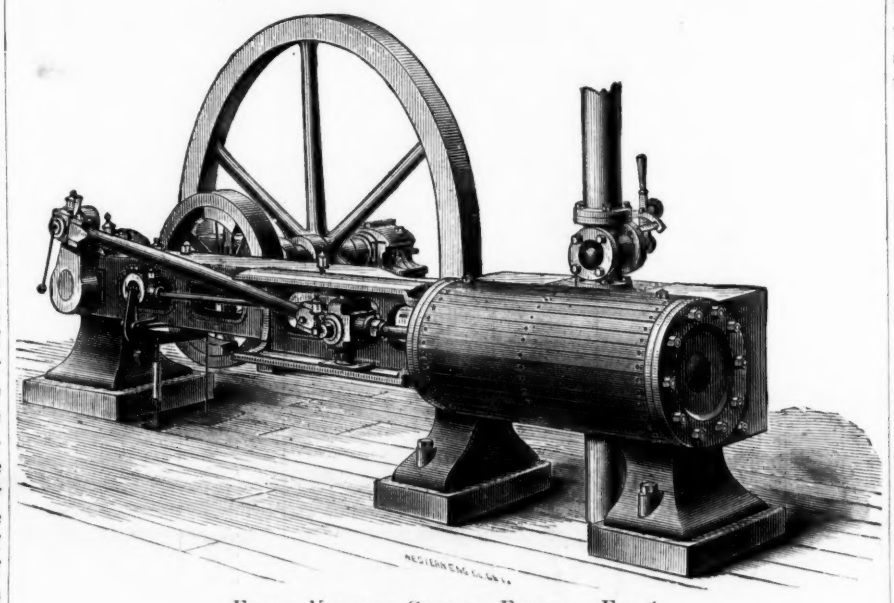
By adding to or taking from the weights on the bell-crank lever, it is evident that, within certain limits, the speed of the engine may be varied at will, while running, still having the speed under control of the governor.

The wear of the parts of this governor, whatever it may be, is at all times in one direction, thus preventing any evil effects from this cause.

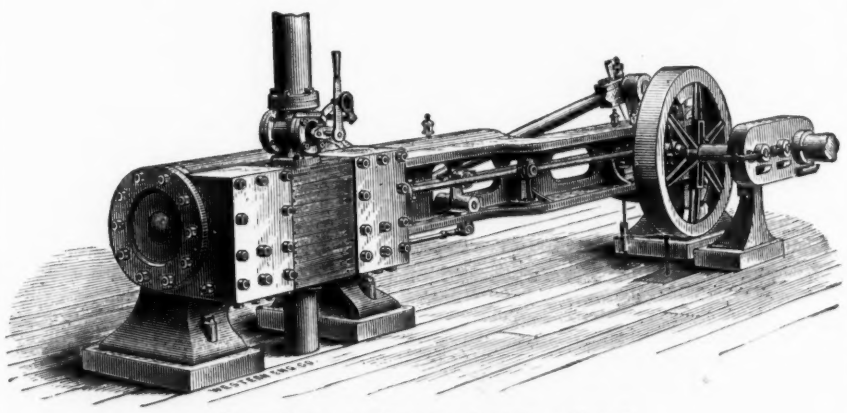
The gearing, by means of which the governor shaft receives its motion, is encased in an oil box, which keeps the parts at all times lubricated, excludes dirt and foreign matter, and does away with the danger of accidents.

Figs. 5, 6, 7 and 8 represent the cylinder in different views and sections, from which the construction and arrangement of the valves may be seen. These are plain flat multi-ported slides, the exhaust valve being quite distinct from the steam valve. The steam and exhaust valves are driven from an eccentric made in one piece with the governor shaft, motion being communicated from this eccentric to these valves from the top and bottom of the rock-arm, shown in Fig. 2, while the cut-off valve is driven from the automatically adjustable eccentric, as described.

Increasing the number of ports requires less valve travel, and the arrangement of the valves leaves less unbalanced area, thus reducing the friction, and correspondingly decreasing the power required to operate the valves, and decreasing the wear of valves and seats. The valves are conveniently arranged for adjustment. Other and more general features of the construction of this engine may be seen from the engraving.



FRONT VIEW OF CUMMER ENGINE.—FIG. 1.



BACK VIEW OF CUMMER ENGINE.—FIG. 2.

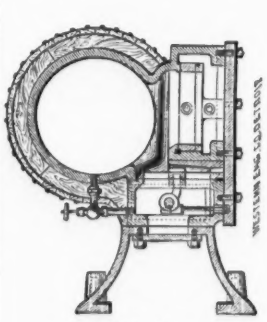


FIG. 6.

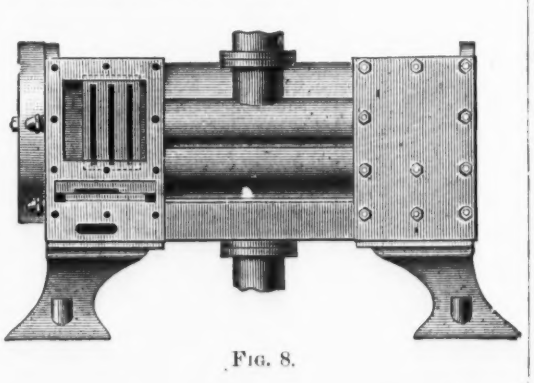


FIG. 8.

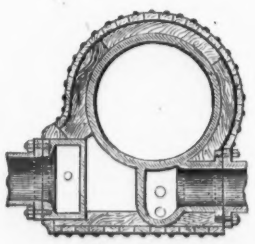


FIG. 7.

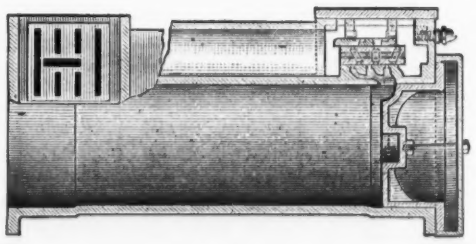


FIG. 5.

It is claimed that this construction, by reducing the travel and the unbalanced surface, does away with any necessity for balancing the valves, with its attendant complication, and at the same time that flat wearing surfaces, easily made and as easily repaired, are preserved throughout; also that the governor, by being of ample power, and directly connected with the work, together with the feature by which a positive weight permits the use of a light instead of a heavy spring, is enabled to control the speed within very narrow limits.

New Table of Indicated Horse Power.

BY W. A. HAMMETT.

The following examples will enable the reader to better understand and use practically the table of constants on page 2, for determining the actual horse power of steam engines:

Suppose we have an engine with a cylinder of 24 inches diameter by 5 feet stroke, making 75 revolutions per minute. The piston of an engine with a 5-foot stroke travels 10 feet at each revolution, and if it makes 75 revolutions per minute, we will have 750 feet as the piston travel per minute. Looking down the first column under the head of "Diameter of Cylinder" we come to 24, then from the top under the head of "Piston Travel," we run down the column to 750, and find opposite the 24-inch diameter 10.279, which is the horse-power constant for *each* pound of M. E. P. (mean effective pressure), and to find the total horse power of an engine we simply multiply the M. E. P. which was obtained from the indicator card, by this number. Suppose we have 40 lbs. M. E. P. by card, then our engine will be developing $10.279 \times 40 = 411.2$ horse power.

Any piston speed can be obtained from the above table by simply multiplying and dividing. For instance, suppose we had the same sized engine as given in the last instance, but only making 70 revolutions per minute, which would give 700 feet piston travel. Now, there are two ways of obtaining this; first, by taking twice the amount given under the 350-feet piston travel, which is $4.797 \times 2 = 9.594$, which is the required constant; or, we can get the same result by taking one-half the difference between the 650 and 750 and adding it to the 650-feet piston travel. Example:

Number opposite 24 under 750 is.....	10.279
" " " 650 is.....	8.908
Difference between the 650 and 750 is.	1.371
½ " " " " " ..	0.686

Added $8.908 + 0.686 = 9.594$, which is the same number we obtained before by the other way, for 700-feet piston travel per minute.

Suppose you have an engine $11\frac{1}{2}$ inches diameter by 20 inches stroke running at 129 revolutions per minute; 20″ stroke = 40″ per revolution, which is equal to $3\frac{1}{4}$ feet per revolution × 129 revolutions = 430 feet piston travel per minute.

Number opposite $11\frac{1}{2}$″ under 450=	1.414
" " " " 400=	1.257
Difference between 400 and 450.....	0.157

$\frac{2}{5}\frac{0}{0} = \frac{2}{5}$, and ½ of 0.157 = 0.0314

$\frac{2}{5}$ of 0.157 = 0.0942

1.257 + 0.0942 = 1.351, which is the required constant for 430 feet piston travel.

New Friction Clutch.

We present with this engravings representing an application of a new friction clutch, brought out by the Howard Patent Metallic Brush Company, 48 Washington street, Boston, Mass., and shown as applied to a press manufactured by them.

Fig. 1 represents the device as applied to the press, of otherwise ordinary construction, and Fig. 2 represents a different view of the same application. In Fig. 2 so much of the detail is shown as to enable the principle upon which this clutch operates to be understood.

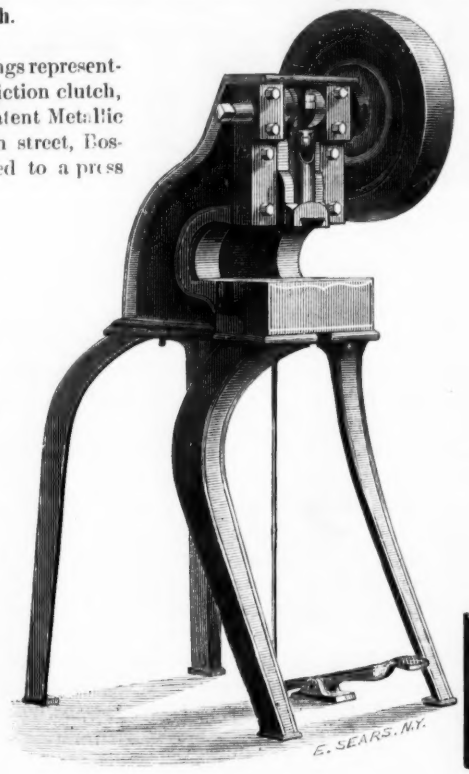


FIG. 1.

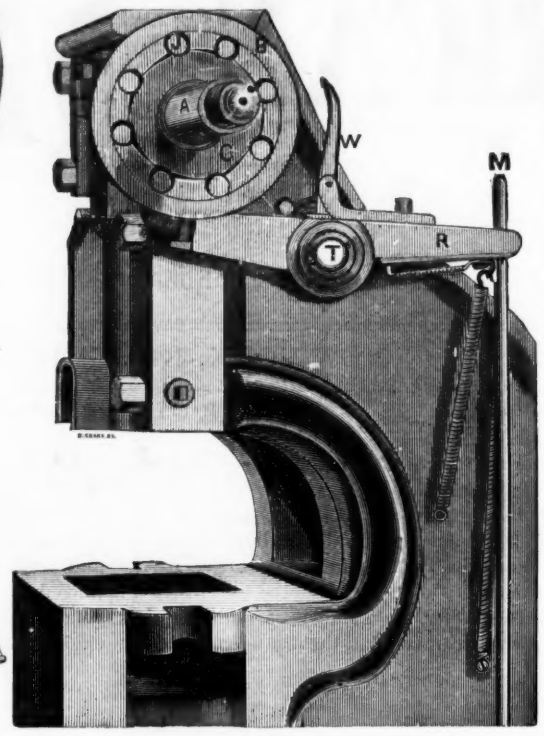


FIG 2.

As here shown, the clutch is arranged for the specific purpose of connecting the driving wheel with the shaft at the will of the operator, and to provide for the automatic disconnection of the same at a definite time in the revolution, as at each stroke of the slide; in other words, the connection is made by the operator, while the disconnection is made without any effort on his part. By this means it is claimed that, not only are serious accidents prevented, but that much more work can be accomplished in equal time.

It will be understood that this is only a special application of this clutch, and that it is designed for any use for which a friction or cut-off clutch is required, the essential parts being substantially the same for whatever purpose used.

Referring to Fig. 2, *A* is the principal shaft of the machine. Upon this shaft is rigidly keyed the collar *C*. To this collar is loosely fitted a disc, a portion of which is seen between collars *B* and *C*. To the outside of this disc the ring or annulus *B* is loosely fitted. This ring is immovably fixed in a recess in the driving wheel, thus to all intents being a part of it.

The collar *C*, has on its perimeter a number of grooves (in this instance eight) at equidistant intervals. The outline of these grooves represents portions of the circumferences of circles, while between the grooves the metal of the collar is cut away to an outline representing parts of circles eccentric to a circle struck from the center of the collar. These eccentric portions of the boundary of the collar are, in effect, wedges, for a purpose to be hereafter seen.

Through the outer section of the disc are holes corresponding with the grooves in the collar *C*. These holes cut this section entirely through, vertically. When the several parts are assembled, the holes in the disc and the grooves in the collar admit freely the rollers *J*, in such a way that they are just out of contact with the inner surface of the ring *B*, but are at the same time free to be moved in a direction to bring them in contact with that surface.

To bring about the contact between the rollers and the inner diameter of this ring, required to frictionally lock the driving wheel and the shaft, it will readily be seen that it is only necessary to slightly revolve the disc (which is free for that purpose) in a direction towards the concentric or wedge portions of the periphery of the collar *C*, the disc carrying with it the rollers *J*, out of the groves and upon the wedge surfaces, which force them outward and into contact with the inner surface of the ring, thus frictionally connecting the driving wheel and shaft, and compelling the one to partake of the revolution of the other. The disc receives the partial revolution referred to by the operation of a spring, inside, and not shown in the engraving, which, when not restrained from doing so, will rotate the disc to bring about the engagement of the parts as described.

So far as referred to, the operation of the parts of this device will be to keep the clutch operative to continuously connect the driving wheel and shaft. The disc is held in a position to disconnect the wheel and shaft, which is the normal condition, by means of the bar *R*, pivoted at *T*, the inner end of this bar coming in contact with a stop on the disc, holding it against the tendency of the spring to move it, and in such a position that the rollers are in the grooves in the collar, and thus out of contact with the ring *B*.

Assuming the mechanism to be in this position, viz, with the wheel and shaft disconnected, the engagement is brought about by pressing a foot lever, which, through the rod *M*, tilts the bar *R*, releasing the end from contact with the stop on the disc, and permitting the spring to move the disc to connect the parts. To provide for automatic disengagement after one revolution, it is not necessary that the operator take his foot from the lever, or in any way concern himself, as the arrangement is such that a suitably situated stud operates a latch in a way to permit the inner end of the bar *R* to drop independently. This brings the end of the bar in the position to be struck by the stop on the disc, arresting the motion of the latter till the rollers, by the continued motion of the other parts, drop into the grooves in the collar, and making the stop motion a part of the revolution, and hence entirely positive. To avoid the shock due to the contact of the lever and the stud, there is in the end of the former a rebounding plunger, or pin, with a spring behind it. This plunger, by opposing a

INDICATED HORSE-POWER FOR EACH POUND AVERAGE PRESSURE ON A SQUARE INCH, WITH DIFFERENT DIAMETERS AND SPEEDS OF PISTONS.

Diameter of Cylinder.	SPEED OF PISTON IN FEET A MINUTE.									
	240	300	350	400	450	500	550	600	650	750
inches.										
4	·091	·114	·133	·152	·171	·19	209	·228	·247	·285
4½	·115	·144	·168	·192	·216	·24	·264	·288	·312	·36
5	·144	·18	·21	·24	·27	·30	·33	·36	·39	·45
5½	·173	·216	·252	·288	·324	·36	·396	·432	·468	·54
6	·205	·256	·299	·342	·385	·428	·471	·513	·555	·641
6½	·245	·307	·391	·409	·461	·512	·563	·614	·698	·800
7	·279	·348	·408	·466	·524	·583	·641	·699	·756	·874
7½	·321	·401	·468	·534	·602	·669	·735	·802	·869	1·002
8	·365	·456	·532	·608	·685	·761	·837	·912	·989	1·121
8½	·413	·516	·602	·688	·774	·86	·946	1·032	1·118	1·29
9	·462	·577	·674	·770	·866	·963	1·059	1·154	1·251	1·444
9½	·515	·644	·751	·859	·966	1·074	1·181	1·288	1·395	1·610
10	·571	·714	·833	·952	1·071	1·190	1·309	1·428	1·547	1·785
10½	·63	·787	·919	1·050	1.181	1·313	1·444	1·575	1·706	1·969
11	·691	·864	1·008	1·152	1·296	1·44	1·584	1·728	1·872	2·160
11½	·754	·943	1·1	1·257	1·414	1·572	1·729	1·886	2·043	2·357
12	·820	1·025	1·195	1·366	1·540	1·708	1·880	2·050	2·222	2·564
13	·964	1·206	1·407	1·608	1·809	2·01	1·211	2·412	2·613	3·015
14	1·119	1·398	1·631	1·864	2·097	2·331	2·564	2·797	3·029	3·495
15	1·285	1·606	1·873	2·131	2·409	2·677	2·945	3·212	3·479	4·004
16	1·461	1·827	2·131	2·436	2·741	3·045	3·349	3·654	3·958	4·567
17	1·643	2·054	2·396	2·739	3·081	3·424	3·766	4·108	4·450	5·135
18	1·849	2·312	2·697	3·083	3·468	3·854	4·239	4·624	5·009	5·78
19	2·061	2·577	3·006	3·436	3·865	4·295	4·724	5·154	5·583	6·442
20	2·292	2·855	3·331	3·807	4·285	4·759	5·234	5·731	6·186	7·138
21	2·518	3·148	3·672	4·197	4·722	5·247	5·771	6·296	6·820	7·869
22	2·764	3·455	4·031	4·607	5·183	5·759	6·334	6·911	7·486	8·638
23	3·021	3·776	4·405	5·035	5·664	6·294	6·923	7·552	8·181	9·44
24	3·289	4·111	4·797	5·482	6·167	6·853	7·538	8·223	8·908	10·279
25	3·569	4·461	5·105	5·948	6·692	7·436	8·179	8·923	9·566	11·053
26	3·861	4·826	5·630	6·435	7·239	8·044	8·848	9·652	10·456	12·065
27	4·159	5·199	6·066	6·932	7·799	8·666	9·532	10·399	11·265	12·998
28	4·477	5·596	6·529	7·462	8·395	9·328	10·261	11·193	12·125	13·991
29	4·805	6·006	7·007	8·008	9·009	10·01	11·011	12·012	13·013	15·015
30	5·141	6·426	7·497	8·568	9·639	10·71	11·781	12·852	13·923	16·065
31	5·486	6·865	8·001	9·144	10·287	11·43	12·573	13·716	14·866	17·145
32	5·846	7·308	8·526	9·744	10·962	12·18	13·398	14·616	15·834	18·270
33	6·216	7·770	9·065	10·360	11·655	12·959	14·245	15·54	16·835	19·425
34	6 59	8·238	9·611	10·984	12·357	13·73	15·103	16·476	17·849	20·595
35	6·993	8·742	10·199	11·656	13·113	14·57	16·027	17·484	18·941	21·855
36	7.401	9·252	10·794	12·336	13·878	15·42	16·962	18.504	20·046	23·130
37	7.819	9·774	11·403	13·032	14·861	16·29	17·919	19.548	21·177	24·435
38	8.246	10·308	12·026	13·744	15·462	17·18	18·898	20.616	22·334	25·770
39	8.648	10·86	12·67	14·48	16·29	18·1	19·91	21.62	23·53	27·15
40	9.139	11·424	13·328	15·232	17·136	19·04	20·944	22.848	24·752	28·560
41	9·604	12·006	14·007	16·008	18·009	20·00	22·011	24·012	26·013	30·015
42	10·065	12·594	14·693	16·792	18·901	20·99	23·089	25·188	27·287	31·485
43	10·56	13·20	15·4	17·6	19·8	22·0	24·2	26·4	28·6	33·0
44	11·046	13·818	16·121	18·424	20·727	23·03	25·333	27·636	29·939	34·545
45	11·563	14·454	16·863	19·272	21·681	24·09	26·399	28·908	31·317	36·135
46	12·086	15·128	17·626	20·144	22·662	25·18	27·698	30·216	32·754	37·770
47	12·614	15·768	18·396	21·024	23·652	26·28	28·908	31·536	34·164	39·420
48	12·846	16·446	19·187	21·928	24·669	27·41	30·151	32·152	35·633	41·115
49	12·913	17·142	19·999	22·856	25·713	28·57	31·427	34·284	37·141	42·855
50	14·28	17·85	20·825	23·8	26·775	29·75	32·725	35·7	38·675	44·625
51	14·832	18·54	21·665	24·76	27·855	30·95	34·045	37·08	40·205	46·425
52	15·437	19·296	22·512	25·728	28·944	32·16	35·376	38·592	41·808	48·240
53	16·041	20·052	23·394	26·736	30·078	33·42	36·762	40·104	43·446	50·13
54	16·656	20·82	24·29	27·76	31·23	34·7	38·17	41·64	45·11	52·05
55	17·275	21·594	25·193	28·792	32·391	35·99	39·589	43·188	46·787	53·985
56	17·909	22·386	26·117	29·848	33·579	37·31	41·041	44·772	48·503	55·965
57	18·557	23·196	27·062	30·928	34·794	38·66	42·526	46·392	50·258	57·99
58	19·214	24·018	28·021	32·024	36·027	40·03	44·033	48·036	52·039	60·045
59	19·902	24·852	28·994	33·136	37·278	41·42	45·562	49·704	53:846	62·13
60	20·558	25·698	29·981	34·264	38·547	42·83	47·113	51·396	55·679	64·245

gradually increasing resistance, serves this end.

By the pressure of the foot the connection is instantly made; that is, the clutch operates simultaneously with the pressure, without waiting for a partial revolution of the driving wheel, greater or less in extent, in proportion to the accidental relative position of the parts. This feature, it is claimed, results in a material saving of time, not only that lost while waiting for the wheel to pass through the part of the revolution necessary to bring about such a relative position of the parts as to permit the clutch to become operative, but also in that it permits the operator to make his motions in unison with the motion of the press, so that they become in a certain sense mechanical.

When it is desirable to bring about a continuous revolution of the shaft, a small collar (not shown) is adjusted on the rod *M*, under the bar *R*. This collar prevents the bar from tilting to disengage the clutch, thus making the motion continuous as long as the rod is held down by the foot pressure. Although in the instance here illustrated the wheel is the driver, it will be obvious that it is quite immaterial to the operation of this clutch whether the wheel drives the shaft, or *vice versa*.

When used for other purposes, as for hoisting engines, pulleys, cut-off for lines of shafting, etc., a slight modification of the parts is necessary. The distinctive features, however, whereby the momentum of the parts are made to do the work of engagement and disengagement, thus relieving the operator from doing more than to indicate the requisite changes, are preserved.

The parts of this clutch subject to wear, viz., the collar, ring and rollers are of steel, hardened, which, with the almost entire absence of a tendency to slip, results in these parts retaining their shape through long use. At the same time the absence of shock in going into gear permits it to be used at the highest speeds, and its great holding power fits it for heavy driving.

The National Association of Stationary Engineers has been increased by the addition of a new local society. Saturday evening, Nov. 4th, an Engineers' Association was formed at Worcester, Mass., with 35 charter members, and there is every prospect of its becoming a strong organization. The National Association is now constituted by local societies in each of the following cities: Providence, Boston, Lynn, Springfield, Mass., New York, Brooklyn, Philadelphia, Wilmington, Del., Chicago, Detroit, Rochester, and Worcester. Among the large cities as yet unrepresented are, St. Louis, Cincinnati, Cleveland, Indianapolis, Buffalo, Baltimore, and Pittsburgh. It is expected that steps will be taken to have each of these cities represented. The one leading object of these associates is mutual improvement of the members in all that pertains to their business. Questions of trades unions, wages and strikes, are *positively excluded* by their national constitution. While users of steam power are giving large attention to the improvement of boilers, engines and their attachments, would it not be wise to take some direct interest in the improvement of engineers?

The President of the National Association is Henry D. Cozens, Providence, R. I., and the Secretary, A. M. Davy, Detroit, Mich.

In regard to the comparative value of wet and dry coal, a series of tests has been recently made at Bochum, Germany, which substitutes facts for theoretical considerations. A lot of washed slack, holding 18 per cent. of water and 9.9 per cent of ash, evaporated 5.7 pounds of water per pound of fuel; while the same coal, with only 3 per cent. of water, made from 8 to 8.5 pounds of steam. Making due allowance for moisture by reducing to a standard of like quantities of coal, free from moisture, there is found to be a direct loss by using wet coal of 14 per cent.

Water Power.

The *American Miller*, in its last issue, copies from our columns an article on "Water Power," and takes occasion to comment editorially as follows:

We note that many of our exchanges are inclined to speak disparagingly of water power as being unreliable. This is the tenor of an article which appears in this issue, copied from the *American Machinist*.

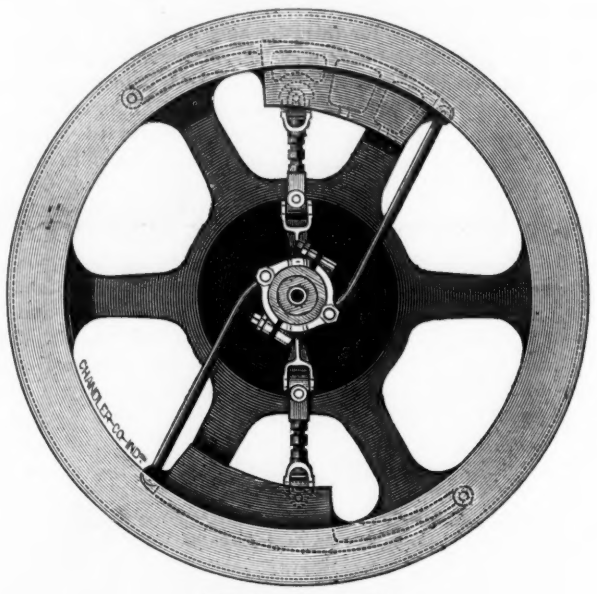


FIG. 4.—See page 1.

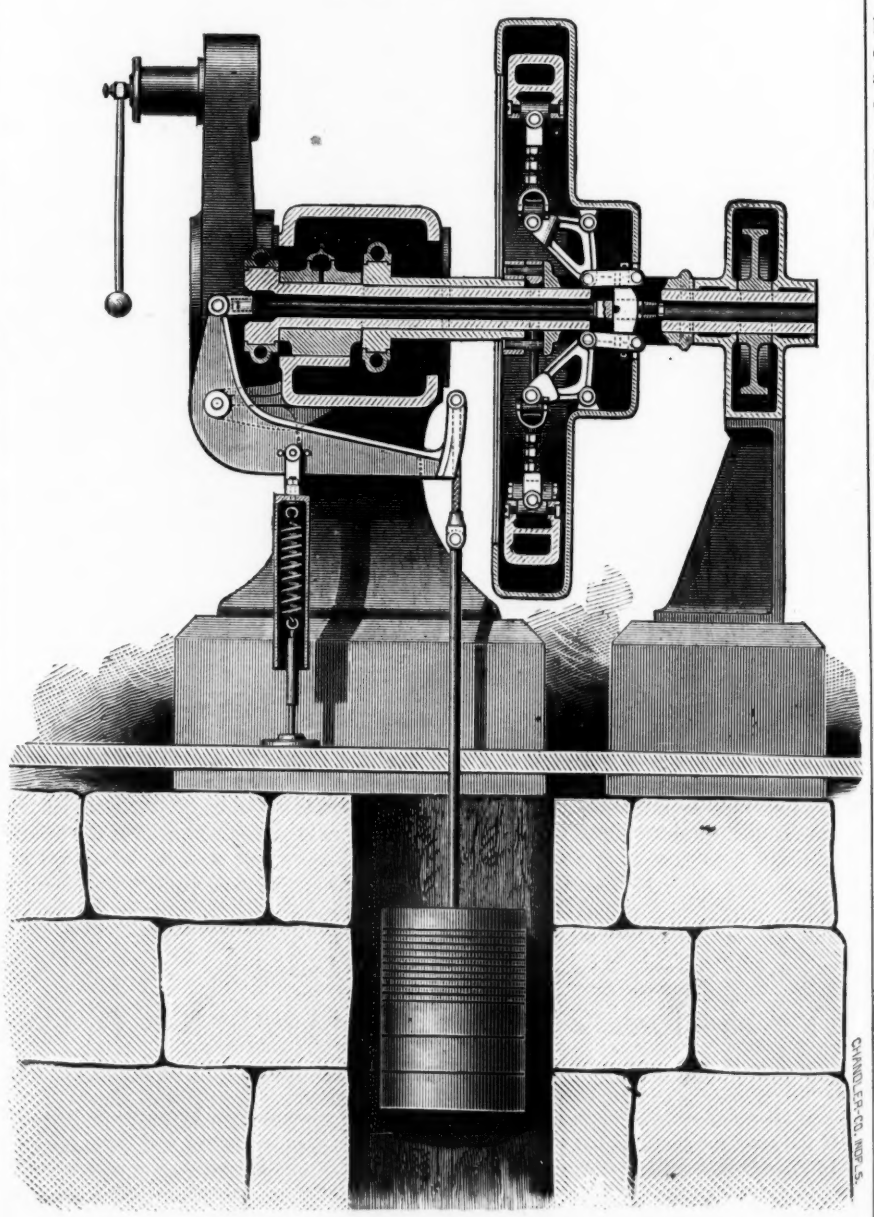


FIG. 3.—See page 1.

While steam power has certain undeniable advantages, water power is and always will be the cheapest power wherever anything like a uniform supply is obtainable. Steam power costs money per horse power; water power generally does not.

A careful reading of its own columns will, we think, convince our contemporary that it has not the occasion to so entirely disagree with our views as seems apparent. For instance, in the article from which it quotes, the first sentence reads: "Water power, on the ground of economy, may be desirable when it can be obtained with regularity." What we desire to emphasize is the difficulty of obtaining it with regularity. The trouble is not that water powers are not, as a rule, sufficiently "improved;" but that they are altogether too much improved;—"improved" to such an extent that many of the users are quite likely to find themselves, at certain times in the year, without the means of turning their wheels.

We take decided exceptions to the last sentence—or rather to the last part of it—quoted above, viz.: "Steam power costs money per horse power; water power generally does not." Steam power does cost money, and it generally yields returns, by furnishing the most satisfactory of all power, ready at all times. But water power costs money—sometimes more money than steam power—as has been not unfrequently found out, not to the entire satisfaction of the parties most interested, and the power is not always at hand when wanted, which incidentally adds to its cost. The too commonly accepted statement that water power costs nothing, sometimes leads to costly selections in manufacturing enterprises. Disinterestedness has hardly reached the point where those who are willing to build dams and reservoirs, and to locate water-wheels and keep the whole in repair, are readily found, and until this time does come, water power, like steam power, will continue to cost money.

As a further argument in favor of steam power, by inference, the number of the *American Miller* referred to contains, at least, three distinct articles—one of them really pathetic—which go to show some of the unpleasant features of water power.

Boiler Treatment and Engine Management.

BY DYNAMICUS.

There being so many engines in use where first-class engineers cannot be employed, it may be of service to such persons to give a few simple rules to be observed in the management of boilers and engines. As new boilers have more or less oil in them, it is best to blow out the first filling of water at the end of a day's run. This need only be done where there is a tendency to foam. A small amount of oil will prevent incrustation.

The supply of feed water should be regular. In no case should the feed pump be required to lift water more than 5 or 10 feet, and where the water is fed hot, it should come from a tank situated above the pump.

If from the high temperature of the water the pump refuses to work, a remedy may be found in allowing a slight leakage around the plunger, thus allowing the accumulation of vapor to escape. A very small air-cock may serve the same purpose.

Never fire when the water is below the lowest gauge.

The safety valve should receive daily attention, and if not raised by the steam, should be raised by hand.

Frequent firing is most economical. Sudden cooling is injurious to a boiler. Portable boilers in particular should not be blown off entirely when steam is above ten pounds; the doors should be kept shut while cooling.

The efficiency and durability of a boiler are greatly increased by keeping it clean. Where water contains sediment, cleaning should be frequent.

New engines that have been exposed in shipping should be thoroughly cleaned before starting, and oil of *a good quality* freely used during the first few days' run.

A priming tendency will sometimes be obviated by opening the throttle valve slowly. Cylinder cocks should always be open on starting the engine. All leaky joints should be stopped at once, and loose boxes taken up as soon as discovered.

The governor belt should be kept tight, to insure sensitive action of the governor.

To lubricate the cylinder and valve, either cylinder oil or tallow should be used. Lard oil is not good for this.

Belts, when new, frequently slip or require to be unusually tight.

An application of equal parts of neat's-foot oil and tallow will be found very good on leather belts, and on rubber, either linseed oil or castor oil—the latter preferred; but a small amount at a time will be needed. Animal oil should never be applied to rubber belts.

By observing the above, and exercising good judgment, but little trouble may be apprehended in the management of an engine.

In the description of Fay & Scott's Hollow Spindle Speed Lathe, contained in our issue of Nov. 11, 1882, the diameter of small journal on spindle should read $1\frac{7}{16}$", instead of $1\frac{1}{16}$". In the Machinists' and Engineers' Supplies, same issue, Benjamin F. Kelley, 20 Cortlandt street, New York, through a mistake of the printer is made to appear as agent for something which would be taken for an Indicator. It should read, Jenks Duplex Injector.

A New Iron Planer.

We present herewith an engraving of a new iron planer, designed and manufactured by H. C. Pease & Co., Worcester, Mass.

It has been the purpose of the manufacturers in designing this planer to secure a machine tool which, while possessing all the advantages of handiness and convenience of operation, should, at the same time, have more than ordinary stiffness, and adaptability to heavy and rapid work.

The engraving shows at once some of the most prominent characteristics of this planer. The bed, as will be observed, is unusually deep and strong, and the tracks for the platen well separated, to secure strength and stability in the support of the table.

The cross-head and uprights are staunchly built; the former being of good width, having large bearing surfaces upon the uprights, and is strengthened by having two deep convex ribs cast upon its back.

The width of the uprights is of good proportion, having ample bearing surfaces upon the bed. They are lightened by three round holes located in the neutral axis of each of the uprights, as seen in the engraving. From the foregoing description it will be seen that a firm support is afforded the tool, as well as for the table.

The ratio of belt travel to table travel in this planer is unusually large, thus securing the power necessary to carry a heavy chip, while its general design secures the strength which enables this machine to do its work smoothly, without springing or chattering.

This planer will carry a smoothing chip of $\frac{5}{8}$" in width with perfect smoothness.

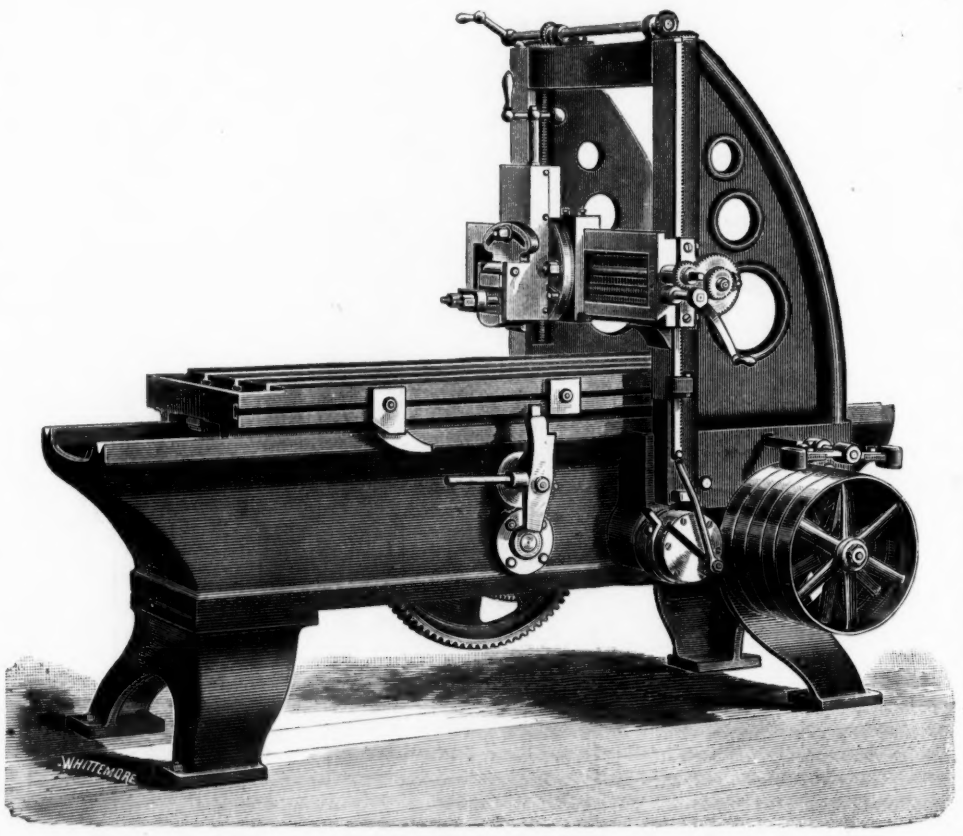
The shipping motion works smoothly and without jar in reversing the motion of the table. Upon short strokes this superior feature becomes very apparent.

The feed gear of this planer is very satisfactory, the cross-feed having a capacity of feeding from $\frac{1}{96}$" to $\frac{5}{8}$."

Change of feed is effected by means of a change gear working on the feed rods, running horizontally through the cross-head. By this means, it is impossible for both horizontal and vertical feeds to be in operation at the same time.

The shoe upon the tool head is made thicker in this than in the ordinary practice, allowing the use of large feed gears within the head. These gears, to ensure the greatest durability, are made of steel. The feed-gear upon the vertical screw may be thrown out of gear at will. This relieves the whole train of gears within the head, as well as the horizontal feed rod passing through the cross-head.

The teeth in the rack and gears are cut. All fits upon this machine are scraped. When ready for shipment, this planer, with countershaft, weighs 3,400 pounds. Before leaving the shop, each planer is fully tested in actual service.



A NEW IRON PLANER.

John Richards, in a recent issue of the *Mining and Scientific Press*, vigorously attacks the common American practice of mounting lathe carriages on *V* ways. He concludes that this practice comes from the old plan of making lathe frames of wood and bolting the ways to them and finishing by chipping and filing or hand planing, and that it is adhered to in present construction from the commercial consideration of cheapness. He states as the conclusion of a number of experiments that a carriage on large flat surfaces, as against a carriage on *V* ways can be moved with less than one-half the power, and argues that there should be gibs the whole length of the carriage, both at the edges and at the bottom, with accurate fitting by scraping; that the edges should be left square instead of beveled, as the latter construction makes increased friction and wear. American tools, he concludes, such as planers, drilling and milling machines, are in most instances superior to corresponding tools in other countries, but this does not apply to engine lathes, which here have objectionable *V* ways, spindle bearings of brass or other soft metal, lead screws at the back instead of the front; carriages held down by springs, and complication and inaccessibility of apron gearing, with want of power in spindle gearing.

Systematic Preservation of Drawings.

BY OBERLIN SMITH.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Having been on several occasions requested by members of this society to give some account of the system of working drawings established by the writer in the machine works with which he is connected, he will commence by saying that the need for this system developed itself gradually, during a number of years, and in connection with a great variety of different kinds of work. Hundreds of drawings had accumulated, being of all degrees of goodness and badness—chiefly the latter. They were principally noticeable for having no two of the sheets of paper of the same kind or size, and for having but few border lines—the views of the objects shown often extending entirely to the edge of the sheet, and sometimes to imaginary realms beyond. As usual with such documents, they were kept in a manner highly conducive to the development of ragged and dirty edges and obliterated pencil lines; for it should be remarked that many of them were entirely guiltless of ink. Being made in such a very miscellaneous way, they of course had upon them no consecutive numbers, and, unfortunately, the dates had oftentimes been forgotten, there being no particular place provided for them, to serve as a reminder. The name of the article shown was usually written somewhere upon the face, and sometimes (if it was a transient job) the name of the customer for whom the work was to be made. They were of various different scales, and in many cases mere sketches, to no scale at all. Bad as this system—or lack of system—was, it probably was a fair sample of the methods in vogue in half the machine shops in the United States.

In providing a remedy for the evils above depicted, the first thing was to adopt a set of sizes for the sheets of paper, and as it was necessary to have a great many small drawings, of punching dies and such articles, the smallest size was fixed upon as 4½ by 6 inches. There were five other sizes, viz., 6 by 9, 9 by 12, 12 by 18, 18 by 24, and 24 by 36. It will be noticed that these sizes were all multiples of the first, and that each sheet was just the size of two of the next smaller sheets, placed side by side. One reason for this was that the paper would cut conveniently and without waste; another, that two or four sheets might be placed together, when desired, in one of the glass-covered frames (in which they were kept for shop use) of a size or two larger than their own frames, in which they would be placed singly. These frames were made in six sizes, to suit the drawings, which, by the way, were known as sizes A, B, C, D, E, and F, respectively, beginning with the smallest. They were made much like a picture frame would be, if it had a solid back board about ½ inch thick and one of the side mouldings hinging outwards, being held when shut by two small, brass hooks. The drawing, and a pane of glass above it, were shoved in sideways when this hinged piece was open.

This arrangement permitted the use of unvarnished drawings — a great advantage where many of them are of a transient nature, and where it is often necessary to use them the first time in an unfinished condition.

The next move was to bring all the odd drawings before referred to into the new system, by mounting them upon suitable sizes of heavy paper (clipping them down smaller wherever practicable), and putting upon them the proper labels. These were inscribed, as will be hereafter explained, and were placed diagonally in one corner of the sheet.

This position was used so that they could be read when either one *side* or one *end* of the sheet was placed upwards, thus enabling advantage to be taken of the *oblong* shape of the paper (a shape adopted for this reason), in arranging views so as to occupy the least amount of space, according to the character of the object shown. After being properly numbered, these old mounted drawings formed the beginning of a series which has since been and is still daily increasing.

The next thing done was to provide a large fire-proof safe with numerous shallow drawers, subdivided to fit the various sized sheets, to hold all drawings not in use. A general classification of subjects was then adopted; *e. g.*, one class embraced all kinds of presses, another all dies, another drilling machinery, etc. Each of these classes was known by a letter of the alphabet prefixed by the word "class." All articles not important enough to be classed alone went into a class miscellaneous. Besides this classification all drawings belonged to one of two grand classes known as "standard" and "transient." In the former were placed drawings of all articles which had been so perfected, and for which there was such a commercial demand as to warrant their being duplicated and made up as stock for the market.

To the latter belonged drawings of any work gotten up especially for particular customers—also standard drawings which, for any cause, had become obsolete. The transient drawings were, of course, usually of a cheaper character than the "standards," oftentimes being mere free-hand sketches.

The numbering of the sheets was purely consecutive, in the order of their being made, regardless of their size or classification. Their position in their drawers was in order of magnitude of numbers, counting from bottom to top, though frequently not by consecutive numbers in any one pile. They were indexed as fast as made, in a book with columns arranged respectively for number, name, size-letter, class-letter and marks denoting standard or transient. From this "blotter" index, as it might be termed, were "posted" all *standard* entries into a classified or "ledger" index made of large cards hung up inside the safe.

The *transients* were not posted, as they could be easily enough found, for the few occasions when wanted, by referring to a special column in the "order-book" headed "sheet number." This number it was the duty of the head draughtsman to enter opposite *every item* of *every order* which was filled by the house. Of course, in a majority of cases these were numbers belonging to standard drawings. By adhering rigidly to this rule, and by holding the draughtsman referred to strictly responsible, a perfect record of all work may be kept, *providing* drawings are never altered, of which, more further on.

Of the mechanical quality of the particular set of drawings whose history is here recounted, high praise cannot be spoken. Many have been made very hastily, and many left incomplete, on account of experimental work requiring frequent changes and improvements. They can, however, where defective, be inked, shaded and otherwise finished up; and, as time is found for doing it, many of them will be destroyed, and substitutes made bearing the same numbers and containing the *same information*, even though they need not necessarily be *fac-similes*. The system by which they are kept is believed to be as excellent in theory as it has proved itself in practice. It aims to be thoroughly comprehensive, and to be so elastic as to permit of an unlimited growth of business, as well as numerous changes in the character of the products delineated in the drawings.

Regarding the technical rules adopted for the making and figuring of the drawings themselves—that is, their mechanical construction—there is hardly space here to write. Possibly they may be of sufficient interest to appear in some future paper. I will only say here, that in placing the different views, the method by "direct revolution" is strictly adhered to.

The labels, before referred to, are inscribed with the size, letter, the sheet number, the name of the house owning the drawings, the date, the class letter, and the name of the article delineated. If standard, the word "standard" is also inscribed. In the case of "transients," the name of the customer and the number of his order, together with the number of the "special job" in the time book to which time is charged, are also inscribed. The labels are printed, with proper blanks left to be filled by hand. They are triangular, in order to occupy as little room as possible in the corner of the sheet.

A vital feature of this system, and the one on which its value as a true record of work done depends, is a strict adherence to the spirit (though not the letter) of the rule *never to alter a drawing in the slightest degree, after it has once received a number*. An infraction of this rule throws all records into confusion, as a drawing is referred to by its number, not only in the commercial books of a house, but on numerous other drawings; yet to keep this rule literally, involves a complete new drawing, costing, perhaps, much time and many dollars, every time the slightest change is made in the machine or other objects which it delineates. This matter of altering drawings is probably the most perplexing subject with which the de-

signer of machinery has to deal, especially if he happens to possess an "improving" disposition, and isn't content with a new machine (or cannot induce the public to be content with it), until it has been altered a score of times. To illustrate how crudely this difficulty is dealt with, even in some of the best shops, I might cite the case of a certain large and well-known engine works, most excellently and systematically conducted, where the only resource, in case of any alteration being desired, is to mark the same in *red* ink upon the original *black* drawing, leaving the black lines intact, as a record of the first construction. In case of a second alteration, I believe their practice is to alter again in red, but how the second construction is recorded I do not know. This method is certainly very objectionable, not only on account of its providing for but one alteration, and because it makes a confusion of lines, but because the red ink should be reserved for dimension lines, and other explanatory matter which is not a part of the construction.

In the system under consideration the difficulty is surmounted by taking a drawing from its place and altering it in whatever way desired, giving it a new number, date, etc., and treating it in every way exactly as a new drawing—regarding the old drawing merely as so much material out of which to manufacture the new one. *Furthermore*, (and this is vitally important) a *substitute* is at once provided for the old drawing, bearing an identical label (except perhaps regarding size of paper) and representing it in all respects. It may be asked: Where is the economy, if the substitute must be like the original? It need not be, only it must contain exactly the same information. This is accomplished by showing upon it, usually by a mounted tracing, a perfect copy of all such parts as have been altered, and also a written inscription thus:—"otherwise like sheet" so and so—naming the number of the newly "manufactured" drawing.

To give an illustration of the above: suppose it is found desirable to alter a machine of which a drawing is shown upon "sheet 100." A tracing or other copy is made of the parts to be altered, together with enough of the contiguous lines to identify its position. This is mounted and labeled just like the original sheet, except that perhaps an economy of paper and storage has been attained by using a much smaller size of sheet, in which case the "size letter" must be changed in the indexes. It is then perhaps found that the last drawing made was "sheet 999." The old "sheet 100" is then altered and its proper consecutive number, "1,000," is affixed. The words "otherwise like sheet 1,000," or their equivalent, are then written upon the new "sheet 100" and the transaction is complete. It has been found practicable to thus "throw forward" a sheet several times without confusing the records. Sometimes this has happened with a 24x36 inch sheet, which has gone forward and left behind it as substitutes only a few 4½x6 inch sheets containing rapidly made sketches or tracings.

It should be mentioned that in case *duplicate* drawings are required they bear the same number as their originals, with the word "duplicate" affixed.

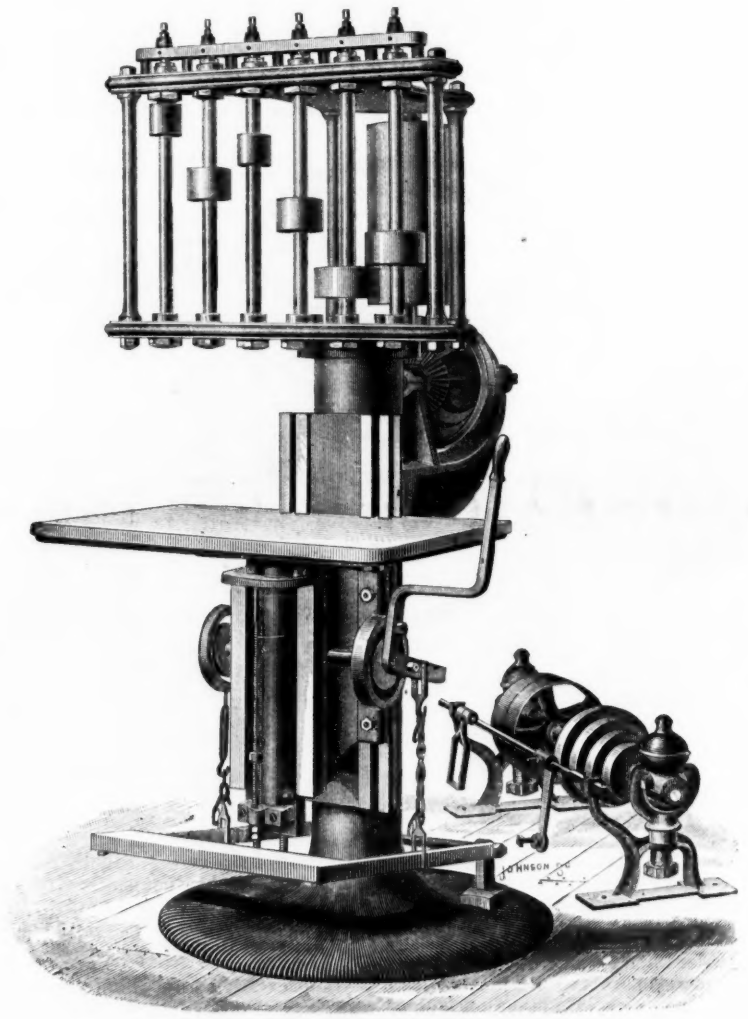
It should be borne in mind that the *essential* parts of this system are the consecutive numbering, the indexing, the substitution of a copy (or of references which make it equivalent to a copy) for all altered drawings, and a uniformity in size and labeling. The dimensions of paper, and the classification into kinds, are matters that may be modified to suit the taste and needs of the user.

Bridgeton, N. J., Nov. 1, 1882.

The *Mechanical World* instances a pair of phosphor bronze slide valves, recently taken out of a locomotive on an English railroad after 6½ years' service, that were believed to be good for a further service of from 3 to 3½ years. They had worn down about ⅜", and the seats were in good condition, showing that the wear, as it should be, had been on the slides rather than on the seats.

Vertical Gang Drills.

The accompanying engraving represents a vertical gang of six drills, as manufactured by the Ames Manufacturing Company, Chicopee, Mass. The general arrangement of the machine may be seen from the engraving. It may, however, be said that the lower ends of the spindles are fitted with anti-friction curved bearings, with take-up boxes to compensate for wear, and that the arrangement is such as to permit the use of longer belts than are generally used with this class of drills.



VERTICAL GANG DRILL.

Electric Lighting in Mills.

BY C. J. H. WOODBURY.

EXTRACTS FROM A PAPER READ BEFORE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, OCTOBER 25, 1882.

* * * * * *

The accumulation of electricity by means of a dynamo machine is based upon two principles: First, that when a wire is moved across a magnet through the field of force, the power exerted against the attraction of the magnet is converted into electricity. Second, when an electric current is passed through insulated wires coiled around a piece of iron, the iron is magnetized.

In a dynamo machine the magnets are very feebly magnetized; but when the armature is revolved it generates an electric current which passes through the wires around the magnets, increasing their strength and enabling them to produce a stronger current in the armature, and this in turn adds to the strength of the magnets, the armature and the magnets reacting on each other until the limit of the capacity of the magnets is reached, after several hundred revolutions of the armature. When the motion of the armature is stopped, the magnets lose nearly all their magetism, as soft iron will not retain magnetism like steel.

Permanent steel magnets were originally used for this purpose; but electro magnets are capable of holding twenty times as much magnetism as permanent magnets.

This is the rough outline of dynamo machines. Their construction is not so simple a matter, involving numerous problems upon matters which cannot be considered here. Electricity for lighting might be furnished by galvanic batteries, but the cost would amount to twenty-five times as much as when generated by a dynamo.

There are two methods of converting electricity into light. The arc light is chiefly due to the glowing of the tips of the carbons, caused by the high temperature produced by the current overcoming the resistance offered by the space between the carbon poles, whereby the energy of the electricity is converted into heat.

The carbons are slowly volatilized, and partially burned. The intensely heated vapor adds to the illumination, but the combustion of the burning carbon interferes with the light, as the arc light is more brilliant by being enclosed in a glass receiver and removing the air. The incandescent light is produced by the current overcoming the resistance offered by a filament of carbon, and raising it to a temperature sufficient to render it luminous.

The immediate destruction of the carbon is prevented by regulating the quantity of the current, and enclosing the carbon in a glass bulb and exhausting the air, so that it cannot burn.

Both the arc and the incandescent lights are due to the glowing of intensely heated carbon. In the arc light the incandescence is destructive to the carbon; and in the incandescent lamp the object is to make the carbon as enduring as possible under the conditions of brilliancy, which are essential for satisfactory results. The arc lamps are placed at openings in the conducting wires, and the carbons form a portion of the circuit. The electricity passes through the lamps in order, and the tension is reduced a certain amount at each lamp.

In the incandescent system, the lamps are hung in wires swung down from the main conductors, so that the current is divided, an equal portion passing through each lamp. The comparison is sometimes made that the main conductors could be represented by the sides of a ladder, while the position of incandescent lamps would be in the middle of the rounds of the ladder.

In the arc light, where the carbon is heated to destruction, the total quantity of light for a given expenditure of electricity is about nine times what it is in an incandescent light working at a commercial rate. In an incandescent lamp, the question of endurance of the carbon is the second factor in determining the most advisable brilliancy for the light.

According to Howell's experiments on the Edison light, if the electricity supplied to a 16 candle power Edison lamp be increased one-fourth, the candle-power is doubled, but the endurance of the lamp would be reduced.

The golden mean of the true economy between expense of renewals of lamps and that of power can be reached only by long experience.

I presume that the present intensity of brilliancy which has been adopted is at about the minimum cost for the present construction of carbons.

The unit of measurement of light is expressed in candle-power, which is the light furnished by a standard wax candle burning 120 grains per hour. The candle power of burning gas is the light given by an argand burner consuming 5 cubic feet of gas per hour.

With the incandescent lamp, the light is nearly uniform in all directions.

In the arc light the terminals of the carbons are different, the lower carbon consuming to a sharp point, and the upper one is blunt and the end concave. The light emitted from these ends is not alike; the upper carbon having the most heated surface, about nine-tenths of the light is thrown downward below a horizontal plane. The power of arc lights, as generally stated, is that of the strongest rays which are thrown down at an angle of 45 degrees, which is about twice the brilliancy of the average light. Nearly half of the light is held back by the white glass shades; and the arc lights being further apart, an excess of light is necessary to secure sufficient diffusion at extreme points, because the intensity of light diminishes as the square of the distance.

* * * * *

IMPROVEMENTS.

The question is frequently asked, will there not be improvements in electric apparatus, so that the light will be furnished for less cost and power? Of course there will be improvements, but it seems as if they would refer to attachments rather than the more permanent portion of the apparatus. The dynamo machines are the most perfect instruments, as they convert 80 to 90 per cent. of the motive power into electricity delivered at the conducting wires. It will be found essential that all dynamos have current governors which regulate the supply of electricity in proportion to the demand, without waste of energy.

There does not seem to be any demand for a change in the system of wiring.

In the arc lamp there is urgent need of better carbons, and in the incandescent lamp there is a demand for the highest qualities of endurance and electrical resistance.

These are all matters of detail, and except the first, refer to portions which are subject to continual renewal.

The so-called "storage" of electricity is a subject which is the object of much interest. Electricity alone, of all forms of energy, is used from hand to mouth, so that the dynamo must be equal to the greatest demand upon the system at any one instant.

All forms of electric lights require uniformity in the speed of the dynamo, and the incandescent lights are especially sensitive to variations in the speed, so that it is frequently advisable to have a separate engine solely on that account. Such uniform speed would not be essential for the dynamo used in charging secondary batteries.

In a storage battery, the electricity is not accumulated in any manner, as is sometimes assumed, but a certain chemical action is produced by passing an electric current through the battery, and later on, a counter-chemical action produces electricity, when the battery is discharged.

The Faure storage battery consists of sheets of lead, coated with red-lead and covered with sheets of felt. The whole is enclosed in a box, and covered with dilute sulphuric

acid. On passing an electric current through the battery, the red-lead on the negative side loses its oxygen, which combines with the red-lead on the positive side, the result being that one coating of red-lead is reduced to pure lead, and the other side changed to peroxide of lead. When the battery is put in use, the theory is that this atom of oxygen leaves the peroxide of lead on one side, and rejoins the spongy lead on the other side, producing the secondary current; but difficulty has been experienced from losses due to various kinds of local action in the battery, such as the deposition of sulphate of lead, and the injury to the sheets of felt, so that the electricity regained has not been as much as is desired.

There are several forms of secondary batteries, all of which are similar in principle; and one free from the faults due to local action would be a great boon to all users of incandescent lamps, for then the apparatus would be permanent, and its efficiency such that would insure commercial success.

Bar Iron Power Shear.

The accompanying engraving shows a powerful shearing machine, designed for cutting either flat or round bar iron. It is made by the Peerless Punch and Shear Company, 36 Dey street, New York, and was designed particularly for use in rolling mills, for shearing all kinds of iron made in 8″ and 9″ trains. The special feature of this shear is the substitution of a crank for the usual cam, to operate the lever. We are informed that in actual service this shear has cut bars ½″ x 6″, and ¾″ x 2½″ flat bar iron, as well as 1¼″ round bar, cold. The tight and loose pulleys are 18″ diameter, with 6″ face. The fly-wheel is 4 feet in diameter, and weighs 710 pounds. The weight of the shear complete is 2,200 pounds, and it occupies a floor space 29″ x 58″.

Report of Committee on Standards and Gauges,

PRESENTED AT THE 1882 ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Your Committee on Standards and Gauges have to report that they have examined the Rogers-Bond Comparator in use in the Pratt and Whitney Company at Hartford, Conn., together with gauges for end measure produced by this machine.

This apparatus is used, first: to compare line measures of length with attested copies of the standard bars of England and the United States; second: to sub-divide these line measures into their aliquot parts, and to investigate and determine the errors, if any, of these sub-divisions; and third: to reduce these line measures to end measures for practical use in the shops.

A paper read by Professor W. A. Rogers before the American Academy of Arts and Sciences, April 14th, 1880, "On the Present State of the Question of Standards of Lengths," and a paper read by Mr. George M. Bond before this society at its regular meeting in Hartford, in 1881, will give all needed information on the subject of standards of line measures.

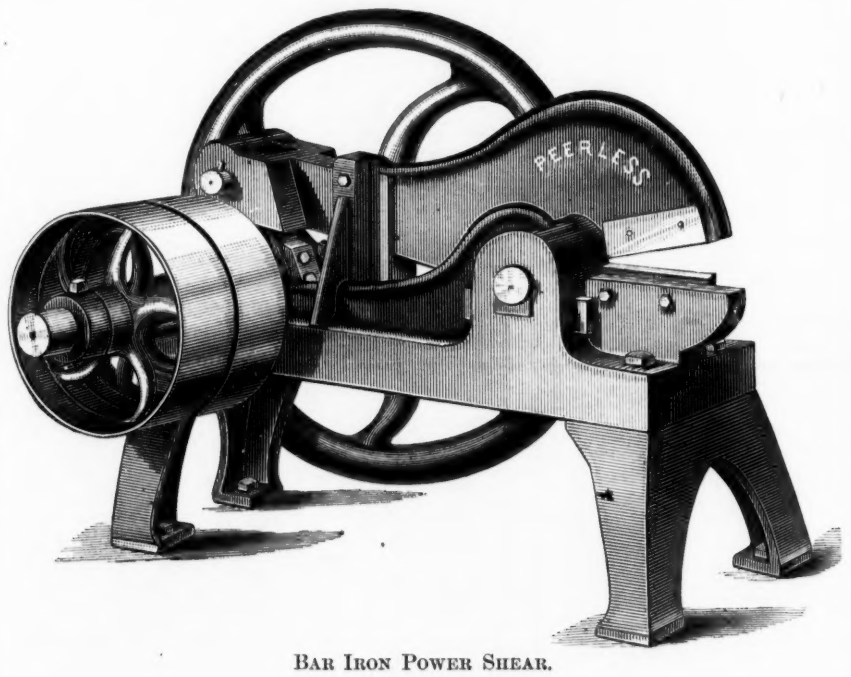
The comparator is provided with two microscopes, their magnifying power being about 150 diameters, each having a micrometer eye-piece, the divisions of which represent about 1-60000th of an inch, and in reading, these divisions are usually subdivided by the eye into tenths, in every case at least three readings being taken, and the mean of the three is used in calculating the result.

The microscopes are mounted upon a carriage which slides freely upon two cylindrical guides, which are heavy tubes of hard tool steel carefully ground true and cylindrical. These are supported at their ends in bearings formed in the heavy cast-iron base of the machine. Counter-weight levers are applied under these tubes at about one-quarter the total length from each end, to overcome the flexure arising from their own weight, and that of the carriage and stops. These stops are arranged so as to be clamped firmly to the guides at any desired distance apart; they serve to limit the motion of the microscope plate or carriage when brought in contact with either stop. The carriage is moved up against the stops by a rack and pinion which is provided for the purpose, the rack being secured to the bed of the comparator between, and independent of, the guide-bars. The abutting surfaces of the carriage and stops are hardened steel, those on the carriage being spherical, while those on the stops are flat, and each stop is provided with an electro-magnet that serves to hold the carriage firmly against the stop, so as to prevent its settling back during an observation.

On one side of the comparator is a table provided with rapid vertical and lateral adjustments, and with a traverse parallel with the motion of the microscope plate of about forty-five inches; on top of this table is an adjustable plate on which the standard bars are laid to be compared. This plate is provided with fine adjustments for parallelism, focus, and position, and several line measure standards may thus be compared at once, under the microscope, without handling the bars. This is an important feature, as it will be evident that errors due to variations of temperature, resulting from handling or from any other cause, must be carefully guarded against. On the opposite side of the comparator is a fixed table or projecting ledge forming part of the base on which this adjustable plate may be placed, so that standard bars may be investigated on either side of the machine. For regular work, this place is occupied by the caliper for reducing from line to end measure. The microscopes are mounted upon the carriage in such a manner that they may be used both on one side, or one on each side of the carriage, at variable distances, according to the character of the work to be examined.

The comparator is firmly supported on solid brick piers, capped with stone, and the movable table, having a traverse of about forty-five inches, referred to above, is on an entirely separate foundation, to avoid all disturbance of the microscopes that might arise from moving the table.

Subdivisions of a standard bar may be compared by placing the microscopes say twelve inches apart, if the subdivisions under investigation are feet, the variation being measured or read by means of the micrometer eye-piece; the standard is then moved under the fixed microscopes, so as to compare each separate twelve inches successively, their valuation being thus determined.



BAR IRON POWER SHEAR.

Another method is, to fix the stops so that the microscope carriage will have a movement of as near the length of the subdivisions to be examined as may be convenient. In this case only one microscope is used, the carriage moving a fixed distance between the two stops, the subdivisions of the standard being thus compared with a constant quantity, and their relation consequently determined.

Line measure standards, may be compared on this machine:

(*a*) By referring the standards to a fixed distance between the two stops.

(*b*) By bringing the defining lines under two fixed microscopes placed the same distance apart as the length of the standards to be compared.

(*c*) By placing two standards to be compared side by side and placing one microscope over each bar, the carriage being then moved the length of the bars, and the relative length of the standards readily determined.

(*d*) By placing one standard on one side of the line of motion of the microscope carriage and one on the opposite side, using one microscope for each bar; by reversing the position of the bars the mean difference may be found.

(*e*) By comparing standards by the use of two microscopes placed horizontally and at a fixed distance apart, so that standards can be compared in the same position and under the same conditions that comparisons are made at the United States Coast Survey Department at Washington.

The microscope carriage should move in an absolutely straight line, and the cylindrical guides give perhaps the closest approximation to this condition. Errors, however, will exist, and the correction for possible horizontal curvature of the guide-bars is found by comparing a standard with a fixed distance between the stops, first on the left hand side of microscope carriage and afterwards on the right hand side, under the same conditions in both cases, of temperature, points of support of the standard and focus. The face of the bar must, in both cases, be maintained in the same horizontal plane, to avoid errors due to vertical flexure of the guides; the difference of the two comparisons with the fixed or constant distance furnishing data for calculating the radius of curvature and the position of the center—that is, on which side it is located—and hence determining the sign of the proper correction, whether it be plus or minus, should the amount be appreciable.

The vertical curvature of flexure may be determined in the same way, using the standard bar placed at variable heights and comparing it with the constant distance moved by the microscope carriage, the microscope and bar being kept always in the same vertical plane, to eliminate errors of horizontal curvature.

In transferring from line to end measure, as the two microscopes do not move in the same vertical plane, correction for horizontal curvature, if of an appreciable amount, must be applied with the proper sign, as remarked before, as in such case one microscope evidently would move a distance differing from that of the other by the difference of the lengths of the subtended chords.

Errors due to vertical curvature or deflection of the guide-bars may be practically eliminated by taking care to keep the surfaces on which the lines to be observed by the microscope are ruled, in precisely the same horizontal plane.

The caliper attachment to the comparator provides means for reducing line measure to the practical form of end measure, and consists of a fixed stop and a movable plunger, cylindrical in form, sliding in well fitted bearings, and having a traverse of about six inches. The abutting faces of the plunger and fixed stop are of hardened steel, three-eighths of an inch in diameter, and are ground to true plane surfaces, which are perpendicular to the line of motion of the plunger.

The plunger is pressed against the fixed stop, and also against anything held between the surfaces of the plunger and fixed stop, by a rod which compresses a spiral spring within the plunger. This rod is clamped to places so as to hold the pressure of the spring constant while the observation is being made, the amount of compression of the spring being made approximately equal in each case. This simple contrivance dispenses with the need of the gravity piece used by Whitworth. No great care need be taken as to the amount of the compression of the springs, as no perceptible difference is shown under the microscope when the spring is compressed an amount varying from a quarter of an inch to two inches and a half. The line upon the plate on the plunger being about 1.30000th of an inch in width, and the line of the micrometer eye-piece being in exact coincidence with the ruled line upon the plate, no change of relative position was perceptible during a continued observation through the microscope magnifying about 150 diameters, while the spring was subjected to varying compression within the above limits. The error due to flexure of the end measures is not appreciable in pieces up to six inches in length, but standard bars of twelve inches and longer require supports, and great care must then be taken to have the bar to be measured parallel to the line of motion of the plunger and microscope carriage.

This caliper is used with two microscopes, one of which is over a finely ruled standard bar, and the other over a finely ruled plate which is attached to the plunger, care being taken to have this plate over its entire line of motion in the same horizontal plane as the surface of the standard ruled bar. The faces of the caliper are brought in contact by the rod and spiral spring, and the microscope adjusted until it bisects the line upon the plate attached to the plunger; the other microscope is set so as to bisect the initial line on the standard ruled bar, both microscopes being firmly attached to the carriage; the plunger is now drawn back, the piece to be tested put between the faces of the caliper and the plunger forced up until the spiral spring is compressed about the same amount as before. The carriage is now moved until the line on the plate is again bisected by its microscope, and the microscope over the standard bar, by the aid of the micrometer, determines the exact length of the piece in terms of the sub-division on the ruled standard. This operation can be performed very readily, and with uniform results; one accustomed to the use of the micrometer will readily measure within one division. A test to determine the accuracy of setting to a single line on the ruled bar, made by six members of the committee—most of whom were quite inexperienced in the use of the microscope—showed between the highest and lowest of eighteen readings a difference of 5.5 divisions, a quantity less than 1.10-000th of an inch, while the average of the eighteen readings differed from the average readings of Mr. Bond by 4.10th of one division, or about 1.150000ths of an inch.

The end measure pieces which your committee were shown at the works of the Pratt & Whitney Company, were stated to be correct within 1-50000th of an inch; and perhaps the severest practical test was made by laying a number of these pieces in a groove planed in a massive block of cast iron, one piece being clamped down to form an end stop, and when the pieces laid down reached the length of 12 inches, another piece was clamped down. A quarter-inch piece was used as a try piece, and was held by a piece of wood inserted in a small hole passing through the piece; the end stops were adjusted until this try piece would just move easily, almost by its own weight. These pieces were then removed, and others which had been laid on the cast-iron block so they might all have the same temperature were substituted, care being taken not to disturb the end stops; some twelve different sets were tried in this way, the same quarter-inch piece being used as a gauge, and these twelve sets were practically uniform in length, with one exception; in this case the quarter-inch piece was quite loose, and accordingly the end measure pieces composing this set were all carefully measured on the comparator, as well as a set that had stood the test; the difference in length between the two sets, one composed of nine pieces and the other of seven, being less than 1-10000th of an inch, and one piece of the set composed of seven pieces, was found to be 1-30000th of an inch short, being exactly one-half the total error of the entire seven as compared with the standard bar, and this was found to be one that had been condemned on account of a defect in the end surface. Dividing the total difference by the number of pieces in the set, the difference noted above, of 1-10000th of an inch between the total errors of the two sets referred to, shows an average of difference for each piece of the first set, as compared to the length of the second set, of about 1-75000th of an inch, and about 1-105000th of an inch as compared with the sub-divisions upon the standard bar, to which they were referred.

The end measure pieces being all referred to lines ruled upon a hardened steel bar, and in a manner which reduces possible errors to a minimum, the liabilty of a deterioration of the standard is eliminated. Errors would certainly result were they all compared with a standard end measure test piece, the use of which, however slight, would be attended with more or less wear, and the original size thus lost. This ruled bar being preserved, the originals may be duplicated at any time. As a standard ruled bar is not handled or touched in any way during the process of measuring, the only risk of change would seem to be that due to internal strain in the standard itself. This point will require close investigation and comparison with other standards to determine the stability of the hardened bar. This standard has been submitted to a process of annealing, at a temperature above any ordinary atmospheric heat due to climate, and this annealing is believed to eliminate the risk of after changes. A recent examination of this standard which was so treated two years ago, shows no appreciable change.

Two adjoining sides of the end measure pieces are first ground by special machinery to plane surfaces which are perpendicular to each other, and the end surfaces are afterwards ground to true planes parallel with each other and at right angles with these side planes, by the use of a fixture which consists of a block having a slot for its

center, the sides of which are exactly perpendicular to the base of the block. The block slides over a plane surface, in the center of which is a copper plug charged with emery or diamond dust. The end measure piece is secured in this slot, and passed over the copper lap until the end is reduced to a polished plane surface; the piece is then reversed and the other end ground in like manner, careful measurements being made from time to time as the piece is gradually reduced in length, and great care taken to have the temperature correspond with that of the ruled bar.

The test of these end measures in the groove of the block of cast iron above referred to, shows the accuracy of this method of manufacture, as any want of parallelism in any of the ends would seriously affect the total length of the set.

Between and below the jaws of the caliper is a small table which can be adjusted vertically for the purpose of calipering the cylinders; the table is adjusted so as to bring the center of the cylinder to be measured to about the same height as that of the plunger, the axis of the cylinder being horizontal; the plunger is then pushed against the cylinder by means of the rod and spiral spring above described. The pressure of this spring is sufficient to move the cylinder on the table until its sides are tangent to the plane surfaces on the plunger and fixed stop. By moving the cylinder back and forth it can be tested for parallelism, and by turning it, the plunger being in each case released and brought into contact again, it can be tested for rotundity, the whole operation requiring but a few moments.

The personal errors in reading by microscope, that is, the variations different individuals would make in reading the intersections of the lines by the micrometer, are eliminated by the process of measuring, the microscope being in each case set to the zero on the ruled bar when the caliper faces are in contact, and also to the proper line when the object to be measured is between the jaws of the caliper, and hence any individual difference there may be in setting will be the same for the readings at each point, *i.e.*, at zero and at the position due to the length of the measured piece; and the difference between two readings gives the length of the piece in terms of the standard bar. As the standard bar used by the Pratt & Whitney Company for all measurements of four inches and under, is of the same material as the end measure pieces and plug gauges no correction for temperature is required, the only precaution being that the piece to be measured shall be at the same temperature as the standard bar, which is readily accomplished by keeping them together for a few hours before measuring.

CONCLUSION.

The completion of the Rogers-Bond Comparator marks a long stride in advance over any method hitherto in use for comparison and sub-division of line standards, combining as it does all the approved methods of former observers with others original with the designers. Comparisons can thus be checked thoroughly by different systems, so that the final results of the series may be relied on as being much nearer absolute accuracy than any hitherto produced.

The caliper attachment to the comparator deserves special commendation, being simple in the extreme, but solving completely the problem of end measurements within the limit of accuracy attainable in line reading, by means of the microscope with the micrometer eye-piece. The standard to which the end measurements are referred is not touched, and each measurement is referred back to the same zero, so that error from end wear does not enter into the problem. This attachment is in advance of all hitherto known methods of comparing end measures either with other end measures or with line standards, both as to rapidity of manipulation and the accuracy of its readings; the strong point in its construction being that it refers all end measures to a carefully divided and investigated standard bar which is not touched during its use, and cannot be in the slightest degree injured by this service, thus giving convincing assurance that the measures and gauges produced by its use will be accurate and interchangeable.

In the opinion of the committee, the degree of accuracy already obtained is such that no useful improvements can occasion changes sufficiently great to affect the practical usefulness of the magnitudes here determined, or the interchangeability of structures based upon them with those involving further acquirements.

Professor W. A. Rogers and Mr. George M. Bond are unquestionably entitled to great credit for the admirable manner in which they have solved the problem of exact and uniform measurement, while the enterprise of the Pratt and Whitney Company in bringing the whole matter into practicable shape is deserving of the thanks of the engineering community.

J. SELLERS BANCROFT,
Secretary of the Committee.
HENRY MORTON,
President.

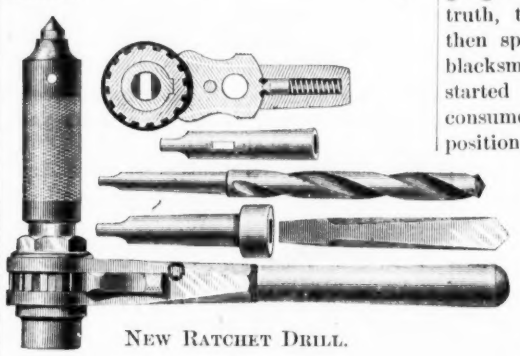
S. W. ROBINSON,
OBERLIN SMITH,
E. H. PARKS,
AMBROSE SWASEY.

On motion, the report was accepted and ordered to be printed; also an attested copy sent to the Pratt and Whitney Company.

New Ratchet Drill.

The accompanying engraving represents a new ratchet drill, now being manufactured by the Billings & Spencer Co., Hartford, Conn. The special object in the construction of this drill is to provide one that may be used for either right or left hand drilling, and that can be changed for either direction without loss of time.

The engraving represents the drill in elevation; also a cross section showing the more important details of construction. Referring to this, it will be seen that the ratchet wheel is double, that is, that it is adapted to be turned either to the right or left according as one or the other side of the pawl is made to engage with it. This pawl is pivoted, as shown in the engraving, and the end remote from the ratchet wheel is provided with three notches.



NEW RATCHET DRILL.

A suitable hole in the handle is fitted with a plunger, the inner end of which is made of a form to enter either of the three notches in the pawl. A spiral spring presses against the plunger, and holds the inner end in either of the notches in which it may be placed. The side of the notches being at an angle, a pressure against the pawl will force the plunger out of the notch in which it may be, and permit it to enter either of the others. The two outer notches provide for motion, the one right-handed and the other left-handed, while the center notch, which is somewhat shallower, provides for holding the drill stock free to be revolved; in other words, it holds the pawl in such a position as not to be engaged with the ratchet wheel.

While this tool presents all the advantages of a strong, well-constructed ratchet drill for ordinary purposes, the facility with which it can be changed from right to left hand will be appreciated by mechanics.

LETTERS FROM PRACTICAL MEN.

Center Reamer—Adjustable T Square Head.

Editor American Machinist:

At this time when the subject of center reamers is being so advantageously and thoroughly discussed, I take the liberty to add a sketch of one that may be new to some reader of the AMERICAN MACHINIST.

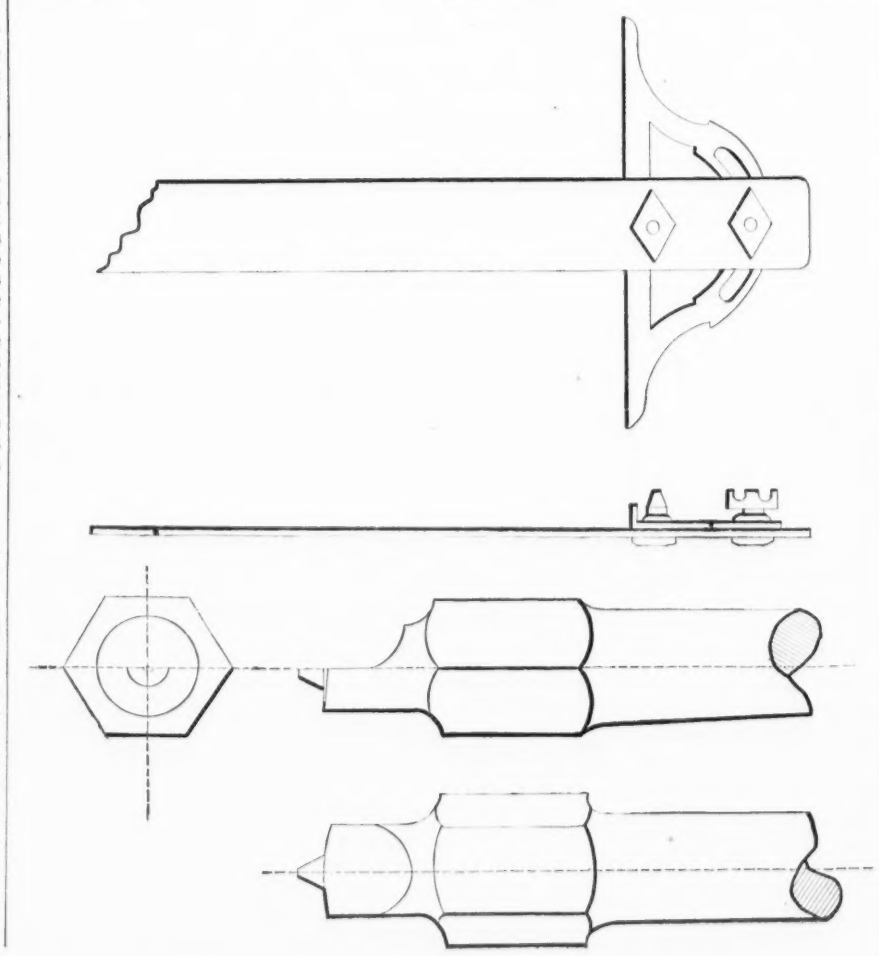
This reamer is not intended for use on very particular turning. But for a large proportion of work incidental to the machine shop it has its advantages. Any one who has used a lathe knows how easy it is in the (ending up) process to break the facing tool when turning down near the center. Young apprentices are especially prone to do this kind of thing. As a rule they are not satisfied with breaking the tool simply, but will gouge into the work, drag the center out of truth, throw the job upon the floor, and then spend fifteen minutes discussing the blacksmith and grindstone, before they get started again. I say nothing of the time consumed in drawing the center to its former position, and the ugly job it makes leaving it out of all proportion to the size of the work.

From the accompanying sketch it will be seen that combined with the center reamer is a counterbore which will face the work for a short distance around the center, thereby obviating the necessity of running the facing tool down so close to the dead center. This tends to keep the centers in one class of work the same size, and also allows the tool to be made stronger. As I remarked before, this cannot be used on the best of work, but when used in its place it is a good thing.

For some time past I have had it in mind to describe a T square which I find very convenient.

But as Joseph V. Meigs submitted a very good adjustable T-square head in a recent issue of the AMERICAN MACHINIST, I will simply add that the head of the one here shown is made of cast brass. The nuts and thumbscrews can also be made of the same material.

If the casting be made sufficiently thin, this will make a light and convenient T-square head. J. H. W.



Machine Tools and Machine Work.

Editor American Machinist:

There are few subjects of more importance, in a machine shop, than the most expeditious methods of tooling off iron and steel. A friend of mine, in speaking of a contract that the company had just finished, said that they would have done much better with more powerful and heavier machine tools.

Their lathes were mostly of the out of-date, light, weakly-geared, skeleton-constructed kind. The double belts had to be excessively tight in order to get the power, thereby increasing the friction, and stretching all the life out of them, besides stretching them crooked, so that they twisted and became useless in less than a year, a serious expense.

Mr. Oberlin Smith, in a late issue of the AMERICAN MACHINIST, ably explained, in the construction of machine tools of the massive, powerful type, that increased friction was amply made up by increased power and stiffness. In both locomotives and horses for freight and draft, there has been a great increase in size and power of late years. Still there are many advocates of smaller locomotives, lighter trains, less horses with more speed, and light, handy machine tools. The strongest opponents of heavy, expensive tools are men who have been trained on the light, handy, cheap, old-school tools.

I read a letter in an English publication, giving an account of a visit to the works of an American firm, where the proprietor was an advocate of the light, handy, cheap type of tools. He allowed they made lathes of 26 ins. swing, that were seldom used for more than three or four inches diameter. He explained the advantages of quickness to handle and shift from one job to another, etc. He (the visitor) stated he saw workmen turning light work, shafts, etc., with a side tool and a feed of 100 to the inch! John Bull seemed to think there must be an advantage in their system, "because the Down-Easters were the closest calculators and the cutest people in the world."

Light shafts are now turned with a much coarser feed than formerly, using a traveling rest or stay, and by using double, triple, and quadruple tools, and even a fluted die to finish with.

For boring bar work, such as quartering driving wheels, boring brasses, &c., a double cutter is better than a single one.

The objection to heavy, powerful lathes, on account of their clumsiness, could easily be overcome by having handy cranes attached; and having the tail stock furnished with rack and pinion, having the top slides of the compound rest easily removed when work requires to be bolted on the saddle, or carriage, for boring bar work.

Stinting metal in a machine where power is required, whether in the bed, legs, headstock, spindle or face plate, is poor policy. That the heavy, powerful machine tools will ultimately prevail, there can be little doubt. It is a mere question of time.

I see some of the turret-headed lathe builders are casting the shears and headstock all in one piece, in order to use the largest possible gear wheel and cone, with a large front bearing and hollow spindle. This is in the opposite direction from some who make the fast headstock so as to compel the use of a small cone and gear wheel; besides being light and hollow, with a tendency to chatter or jar when turning work chucked on the face-plate. In order to make a perfect finish with a flat tool and coarse feed for the last cut (planing machine style) the spindle should be large and the headstock and face-plate stiff. There are locomotives here from nearly every State in the Union, and there is evidently a great difference in the practice as to speed and feed, whether coarse or fine. It can be seen on the frames, the fit of the axles and crank-pins, and on all the heavy unpolished parts.

Machine tools would last much longer if the workmen would take better care of them; much of the abuse of tools comes from men working in a dirty, slovenly, rushing style. The English practice on light lathe work is to finish on hand lathes, and keep slide lathes for turning and screw cutting only. It is nothing unusual in some shops here to see a man filing and polishing on a screw-cutting lathe, with all the gear-wheels flying round at a tremendous speed, making a needless wear.

Of course, for very light work, quick speed and fine feed is the thing, but as some shops practice it on heavy work, I should like to hear their reasons for doing so.

Fort Wayne, Ind. VETERAN.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, F. F. HEMENWAY, } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET, (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST at 16/8 per annum, postage prepaid.

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NEW YORK, NOV. 25, 1882.

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Protecting Industrial Secrets in Europe.

The industrial systems pursued in Europe contrast most strongly with those of America in the secrecy with which they are conducted. It is true that Europe has made considerable progress in liberal ideas since knowledge of various useful arts and processes of manufacture was confined to a few government shops, and so sedulously guarded by the then reigning monarch that the workmen therein employed were virtually prisoners, and the people purposely kept in ignorance of those industrial discoveries that would most benefit them, but much of the old time-honored exclusiveness still remains. Some months ago our Department of State sent a circular to the consuls in foreign countries, requesting them to gather certain facts and statistics concerning the cotton and woolen industries in the principal European trade centers. The results are published in No. 23 of the State Department magazine, making over 400 pages of interesting and valuable information. It is prefaced by an explanation of the difficulties encountered by the consuls in gathering the particulars asked for. Manufacturers, in many cases, flatly refused to give any of the information wanted, evidently fearing American competition, and considering it a wise, selfish policy to withhold all knowledge they could prevent our manufacturers from obtaining. One of the Nottingham manufacturers objected to giving samples unless the Government of the United States made a formal request of the British Government that samples be furnished. The consul at Manchester declares he had more trouble than he anticipated in gleaning needed data. The consul at Leeds says that "there is no little reluctance displayed by manufacturers in furnishing this class of information." In Belgium the consul at Ghent "had to ferret out the information a little at a time." In that country no statistics of production, consumption, or exportation of cotton goods had been collected by the Government, "on account of the manufacturers showing so much reluctance to give the desired information." The consul at Malaga, Spain, says that "all are envious of the progress made by the United States in the manufacture of cotton and woolen fabrics, and they are not at all willing to volunteer information that may show the quantity and cost of goods manufactured." When we come to compare the narrow, mental dispositions of manufacturers in free-trade European countries with the open liberality and universal willingness of American tariff-protected manufacturers to impart industrial information to all foreign manufacturers or their representatives who visit this country, making it a rule to show them through their shops and factories, and explain every tool or process that needs explanation, the contrast becomes striking.

We are so used to being lectured by European free traders (and their representative newspapers in the United States) upon the evil influences of our selfish, restrictive and unenlightened policy of protection to home manufacturing industries, and the liberal golden-rule influence of free trade between nations which is supposed (by them) to break down all artificial barriers to production and trade, and make all men, as it were, "a band of brothers," that it is rather depressing to come against a "Chinese wall" of industrial prejudice and exclusiveness while looking for a little information (such as Americans place at the disposal of any one seeking it) in those countries which have, to the fullest extent, enjoyed the beneficent advantages of free trade.

Two weeks ago we published a list of 132 machine tool builders, since which we have learned of eleven other establishments that should be included in the list, whose names appear below. The Farrel Foundry and Machine Co., Ansonia, Conn., (whom we included in the list) inform us that they do not build machine tools.

H. K. & C. Walcott, Jackson, Mich.

Hoffmann & Billings Mfg. Co., Milwaukee, Wis.

L. D. Cline (Shapers), Alliance, O.

Wm. Munzer (Lathes), New York.
John Birkenhead (Lathes), Mansfield, Mass.
Sibley & Ware (Drills), South Bend, Ind.
Attleboro Machine Co., Attleboro, Mass.
H. Thompson (Drills), Worcester, Mass.
J. E. Merritt Lockport, N. Y.
N. Dustin & Co. (Lathes), Dexter, Me.
Enterprise Machine Co., Geneva, O.

Stability of Machine Shop Tools.

In setting machine tools very little judgment is, as a rule, displayed in preparing foundations for their reception. Heavy machines, such as lathes and planers, are often placed directly upon a floor that is poorly supported, so that if the greatest care is given to the setting of machines the strength of the floor will often prove insufficient to permanently support them, and preserve the alignment. A few years ago some one startled the builders and users of machine tools by the announcement that there was a deflection in the beds of lathes. Some proposed truss braces lengthwise and under the bed; others an addition of extra legs in the middle of the bed, while the latest remedy is a change in the construction of the lathe bed, consisting of increasing its depth from the ends toward the middle, making a *webbed truss brace* as a part of the bed. All these precautions are steps towards improvement, but they are of little value when floors and foundations are neglected.

In visiting different shops we have seen lathes and planers resting upon four legs which were intended to support the weight, yet the whole weight was borne by two legs at opposite corners. It has often been said that "a good workman with poor tools will produce better work than a poor workman with good tools." This may apply to vise work, but it does not hold true in relation to lathes and planers. A good workman cannot do good work upon a poor machine, or to be more specific, he cannot produce a true surface upon a planer that is winding; neither can he turn a long piece of work straight, in a lathe that has a twist in its ways. He can get an approximation to good work, however, by feeding the tool in and out, and using his calipers every inch or two. After this process the liberal use of a file makes the job passable.

In many instances lathes and planers are placed upon a floor in position for running, and are allowed to remain without any change in their support until the floor rots away. They are finally moved only because they are in danger of going through what little remains of the floor. All heavy machines should be placed upon foundations independent of the floor, so that when once set in place and carefully leveled they will remain so indefinitely. It is one of the most singular and lamentable facts that manufacturers and proprietors of machine shops do not appreciate the value of setting tools and machines right at first. It costs a trifle more at first, but the apparent extravagance disappears at once with the advantages gained in the quantity and quality of work turned out. It is an old idea to put legs both at the ends and in the middle of long lathes to support them and preserve the alignment of the ways. It would often be much better if the extra legs were omitted, because they either do not support enough weight, or they support too much, besides giving a twist in one direction or the other.

If extra legs are of any value at all, why not adopt the principle illustrated by the caterpillar, which is probably better supported than any other creeping thing, so far as legs are concerned? As it moves, the body partakes of the contour of the surface over which it passes. It is so with the lathe, or planer, when placed upon its foundation. If this foundation be of stone, carefully laid, the more bearing points upon it the better. We have known instances where the legs have been removed from large lathe beds that possessed insufficient stiffness, and by placing them upon stone or brick foundations, with a good body of cement or brimstone under them, they possessed all the requirements of much larger machine tools resting upon legs. But if a lathe be placed upon a wooden floor that is constantly upon the move, the fewer legs such a machine has the better. The beds of lathes ought to possess sufficient stability to support themselves, by legs at the ends alone, without perceptible deflection. Lathe beds could easily be made of a form which would insure the greatest rigidity, without materially increasing the cost over some of those heretofore made with special features for securing stiffness.

By reinforcing lathe beds by the application of wrought-iron braces, it is a pretty nice piece of work to adjust the length of those braces so that they will pull *just enough, but not too much.* It must also be remembered that the temperature of the room will affect such braces more readily than it will the bed. Even were the surfaces true at a certain temperature, then, as changes occur, either above or below the degree assumed, a variation will be found in the bed, owing to the difference in expansion of the cast-iron bed and the wrought-iron braces.

When a lathe bed has been correctly designed and a good sound casting made, its accuracy can be destroyed in the planing.

If when placed upon the planer the rock and sag of the bed are not disposed of with good judgment, the bed when complete will be sprung either upward or downward. When heavy lathes and planers are placed upon an upper floor, they should rest upon the timbers independent of the floor, so that the floor can move freely under changes of the air, yet leave the foundation of the machines undisturbed.

We know of shops where this plan had to be adoped to secure satisfactory results. The floor was cut through and the legs of the machine made to rest upon timbers placed for that purpose. While the floor warped and the planks shrank, the timbers firmly supported the machines.

If the foundations of machine tools were more carefully observed, placing them on suitable resting places, instead of upon stilts, we would hear fewer complaints of rough work. The tools, instead of chattering with light cut, would produce smooth and true surfaces.

Too often great pains are taken with the lesser details of shops and factories, under the supposition that a great saving is effected. What is needed is to have machine tools so firmly set that they will properly carry any load, within their capacity, that may be placed upon them.

Literary Notes.

STEAM, is the name of a neat, bright, monthly journal just started in Chicago, Ill., in the interests of engineers and steam users, at $1 a year. The first number is by no means dry, but that is no fault with this kind of "Steam." We trust it will not be *throttled* but will be worked expansively.

BELCHER'S PAYMASTER'S ASSISTANT. Two sheets with full printed directions for rapid calculation of wages. Published by E. W. Belcher, Glenwood, Mass. Price $2.00.

This Paymaster's Assistant consists of two printed sheets of figures, 12″x17″, mounted on each side of a card of thick pasteboard coated with shellac to render it impervious to water and dirt.

On one sheet the left hand column reading downward, includes from 30 to 45 hours in even hours, quarter and half hours. The other sheet includes from 45¼ to 60 hours. The upper row of figures, reading across from left to right on either sheet, shows all the rates per hour. To find how much a man's wages amount to anywhere from 30 to 60 hours, we have simply to look for the number of hours worked (found in the left hand column), and then directly under the proper rate per hour (on the same line) for the result. For example: 58¼ hours at 27½ cents per hour = $2.75 per day, or $16 50 per week. On the same line 58¼ hours, under the rate of 27½ cents, will be found the result, which is $16.02. Any number of hours or fractional parts thereof, can be readily calculated. The principal object of this assistant is to facilitate the calculation of rates at odd hours.

The results of such calculations can be seen upon the tables at a glance, thus saving a tremendous wear and tear of brains. The columns of figures are ruled alternately with red and blue, to facilitate the finding of any desired figures. Mr. Belcher is cashier of the Hancock Inspirator Co., of Boston, Mass. By use of the assistant, while engaged by another concern, he paid off 800 workmen per week, with ease.

We are receiving a good many inquiries from persons who are anxious to know what has become of Chordal, and when he is going to begin writing again. The best answer we can make to these questions at present is, that the last time Chordal was in our office, he received a telegram from home announcing the birth of a boy. We are now informed by letter that the boy has been named "Corliss," a right good engineering name, and that it is hoped the cares of business and paternity will soon permit our correspondent's reappearance in our columns.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(411) A. R., Haring, Mich., writes: Which is the best, water or oil, for tempering cold-chisels? *A.*—We prefer water.

(412) J. C., Warren, Mass., asks: What gives a locomotive the adhesion necessary to draw a train? *A.*—The weight on the drivers.

(413) J. G., Baltimore, Md., asks: Is illuminating gas pure hydrogen? *A.*—No. The composition of illuminating gas supplied varies in different localities, and at different times in the same locality, but is never, approximately, pure hydrogen.

(414) W. L. P., Ansonia, Conn., asks: Will a belt run off the near or far side of a pulley, or in other words, will it run to the high or low side? *A.*—A belt will run toward the ends of the shafts that are nearest together. For further information, see "Running Conditions of Belts," by L. F. Lyne, in the AMERICAN MACHINIST of April 17, 1880.

(415) J. P., Ottawa, Ont., asks: 1. Is somewhere in the Eastern States a good place to learn the trade of a machinist? *A*—Yes. 2. Do you think a school course to learn mechanical engineering advisable, after serving an apprenticeship as a machinist? *A.*—If you are financially able, and have the inclination, yes.

(416) E. B. C., Pontiac, Mich., writes: I have a chopping axe that is too soft. A farmer tells me that if I will bury it in the ground till spring it will be well tempered. I am a machinist with some experience in tempering steel, but never heard of this plan before. What is your opinion of it? *A.*—Our opinion is that, like many other traditions, it is without foundation. Why not try it, and so satisfy yourself?

(417) P. G., Rockford, Ill., asks: How can I restore a brass bird-cage that has been lacquered, but that has begun to tarnish? *A.*—Clean by putting in a strong lye made of wood ashes and letting it remain till the lacquer comes off; then to take the dirt off use a mixture of aquafortis and water. Finally clean with pure water. You can make a lacquer of ½ pint rectified spirits of wine, and ½ pound of clean seed-lac. Put the seed-lac in the spirits and keep in a warm place, shaking it frequently till dissolved. To use this, heat the wire till quite warm, and apply the lacquer with a brush. If there is anyone near you who does this, or a similar class of work, it will be much cheaper to pay for having the work done than to do it yourself.

(418) C. L., New York City, writes: I find a rule on page 281 of the Engineers' Handy Book, for calculating the rate of water consumption, that I cannot understand. Also on page 304 of same book is the expression "theoretical clearance." 1. Can you give me any explanations? *A.*—If you cannot understand the rule referred to, use the simpler rule on page 283. We presume by "theoretical clearance" the author means the clearance as calculated from the diagrams. 2. Is it considered good practice to have a return flue over the top of a horizontal tubular boiler? *A.*—Engineers generally do not approve of the practice, except the top of the boiler is covered with non-conducting material. We have, however, known boilers set in that way without any apparent bad results. 3. How can I draw the theoretical expansion curve on an indicator diagram, geometrically? *A.*—See the AMERICAN MACHINIST of March, 1879.

(419) J. D. D., Dansville, N. Y., writes: 1. I have a controversy in regard to the quantity of steel produced in the United States. This controversy arose from an article which appeared in a local paper stating that in England 800,000 tons was produced, and in the United States 750 tons more. Does this mean simply 750 tons or 750,000 more than in England? *A.*—The steel production in the United States during the year 1880 was 6,500,000 tons, and in 1881 it had increased to 8,000,000 net tons. 2. Does a level taken with a water level as described in Davies' Elements of Surveying, Book 3, page 150, show the true level or the apparent level? *A.*—There is no page 150 in book 3 of the work you mention; but if you mean page 250, we would say that the level ascertained is not precisely correct. It is a very close approximation, however, and near enough for all practical purposes.

(420) W. M., Newark, N. J., writes: 1. A person passing, or standing in close proximity to a large, rapidly traveling belt, experiences, under certain conditions, a peculiar sensation on the surface of the skin, due to the presence of frictional electricity generated by the belt. A beautiful blue spark plays about the ends of the fingers if presented to the belt. Does the electricity *leave* or *enter* the person's body so situated, and is it beneficial or injurious? *A.*—Electricity passes from the belt to the body. We do not imagine the effect will be to any appreciable extent, either beneficial or otherwise. 2. In taking indicator cards it is claimed by some that the atmospheric line should be drawn after the diagram has been traced; by others that it should be done first; which is correct? *A.*—Our practice is always to draw the atmospheric line after taking the diagram. The reason for doing so is that the parts of the indicator are then expanded by the heat, and the atmospheric line is more likely to be in its proper position with reference to the diagram.

(421) H. D. P, Gloucester, Maine, asks: 1. Who invented the steam engine? *A.*—The credit of inventing the steam engine cannot, so far as known, be given to any single individual. 2. What is meant by the pitch of gear wheels? *A.*—The distance apart of two adjoining teeth, measured on the pitch line. 3. At what degree of heat do the following metals melt: Iron, Brass, Copper, Lead and Tin? *A.*—Iron (cast), 3479°; Brass, 1900°; Copper, 2548°; Lead, 594°; Tin, 421°. 4. What is red heat visible by day? *A.*—1077°. 5. Has steam that forms before water boils any power? *A.*—It has tension, or pressure, but is of no practical value under ordinary circumstances. 6. Is the strength of a glass tube impaired by a constant pressure inside it? *A.*—If the pressure is nearly as great as the glass will stand, it probably is. 7. What pressure will a common glass water line stand? *A.*—It would be impossible to foretell with any certainty. 8. What is the Keely motor? *A.*—A Philadelphia mechanic by the name of Keely, made, some years ago, something which he *called* a motor.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

"Cures Bad Draft," Parson's Blower on trial.

C. M. Morse, Mech. Engineer, 132 Nassau St., N.Y.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Parson's Blower on trial. 95 Liberty St., N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

J. M. Badger, Expert and Commission Dealer in Machinery, 5 Dey Street, New York.

Hoerle Bros., Naugatuck, Conn. Small Dies and Special Tools to order.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Howard S. Abbot, Solicitor of Patents, 617 7th St., opposite the Patent Office, Washington, D.C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

"Heartily recommend Parson's Blower. We have 22 blowers in active use." Standard Oil Co.

How to straighten and gum all kinds of saws. Send for particulars to A. E. Wilbur, Schenevus, N. Y.

The American Standard of Bolts and Nuts. Price $1.00. Address, E. Lyman, C.E., New Haven, Conn.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

A lot of 25" lathes designed to equal the best Philadelphia tools, will soon be ready for delivery. Ohl & Co., E. Newark, N. J

Engine Lathes, Speed Lathes, Foot Lathes, Upright Drills, Light Drilling Machines and other fine tools, Frasse & Co., 62 Chatham St., N. Y.

Wanted—To sell a Richards' Indicator in good condition. Address, F. G., BOX 1, AMERICAN MACHINIST.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John street, New York. Mention this paper.

L. V. Conover, Iron Founder, 336 to 340 East 29th Street, New York. Heavy and Fine Castings of Iron, Brass, Composition and Copper made to order at shortest notice.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Wanted to arrange with the right parties for the manufacture on royalty or otherwise, of a first-class automatic cut-off engine. Address, Box 10, care AMERICAN MACHINIST, 96 Fulton street, New York.

Our new patent hand-file holds about four copies of the paper in good shape. Very handy for office or library use. Mailed on receipt of price, 75 cents. American Machinist Publishing Co., 96 Fulton street, New York.

The Theoretical and Practical Boiler Maker, 335 pages, and 37 lithograph plates. Published by the author, S. Nicholls, Yorkshire street, Blackpool, England. Mailed on receipt of P.O.O. value $1.83, to Blackpool. See Review, AMERICAN MACHINIST, p. 8, July 22, 1882.

Boiler Shop Tools.—Patent Bending Bolts, Boiler Plate Planers, Combined Punch and Shears, Single Punches or Shears of short or very long reach, Horizontal Flange Punches, Double or Single Bar Iron Shears, Radial Drills. Send to Hilles & Jones, Wilmington, Delaware.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a way that will be instructive to old and young mechanics, and interesting to every body. Over 40 humorous illustrations; 320 pages, 12mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

The *Sanitary Engineer* of Oct. 19, publishes with illustrations the report of Chief Engineer Durand Claye, of Paris, on the just completed Sewerage System of Berlin. It presents in each issue a great amount of matter of special interest to engineers, contractors, steam fitters and plumbers. If any reader of the AMERICAN MACHINIST who may now be buying the *Sanitary Engineer* of news dealers, will request it, the publisher will send him two weekly issues free if this advertisement is referred to. Address the *Sanitary Engineer*, 140 William street, New York. (P. O. box, 3037.)

MANUFACTURES.

The Hot Polished Shafting Works, Youngstown, O., have commenced operations.

A new iron foundry, 50x60 feet, with an 8-ton cupola, is being erected at South Worcester, Mass., by Arnold & Angell, a new firm.

McDermid & Williamson, Cleveland, Ohio, are fitting a shop with new tools, and have commenced to manufacture twist drills, reamers, etc.

The Deane Steam Pump Company have recently sent pumps to Australia, the West Indies, Mexico and South America.

The Hendey Machine Company, of Torrington, Conn., will soon start a branch in Meriden for the manufacture of tools for several factories.

The extensive machine shops of the Chicago, Milwaukee and St. Paul Road, located at Minneapolis, will cost in the neighborhood of $1,500,000.

The Polished Steel Shafting Co.'s works, at Cummings, near Chicago, Ill., has been fitted up fully with machinery and is in operation.

The Morse Twist Drill and Machine Co., New Bedford, Mass., have just completed an addition to their works 175x35 feet built of brick. This nearly doubles their capacity.

The contract for building the new Wilson Sewing Machine Factory in Wallingford, Conn., has been awarded, and work has been commenced. The cost of the factory will be about $50,000.

The Putnam Tool Co., Fitchburg, Mass., write us that they are extremely busy getting ready to start up their new shop in the building of machine tools before cold weather sets in.

F. O. Williams, of Cohocton, N. Y., who was offered $10,000 bonus some time ago to start an agricultural implement factory at Marshall, Mich., will commence operations at once. The factory will employ 50 men.

Jones & Laughlins, Pittsburgh, Pa., have decided to erect an addition 150 feet in length, to their machine shop. To make room for it, two of the houses in the famous Monkey row will have to be torn down.

The Texas and Pacific machine shops at Marshall, Texas, contain a working force of about 600 men—the largest, it is said, of any similar institution in the South. The monthly disbursements to the force amount to nearly $60,000.

H. W. Lafferty, Gloucester, N. J., is enjoying a good trade in sugar machinery, which he is building mostly for San Domingo and the West Indies generally. When sugar trade is dull he builds machine tools.

The Farrell Foundry & Machine Co., Ansonia, Conn., who began the manufacture of chilled rolls in 1869, have now a capacity of seventy finished rolls a day. These are used principally for paper, rubber, brass, copper and grain.

Wm. Munzer, 509 First Avenue, New York, has built 30 of his new pattern engine lathes, and has orders for six more. He has also under construction seven Corliss engines of different sizes, and a number of vertical engines.

The city authorities at Marshalltown, Iowa, exempt from municipal tax all manufacturing establishments for five years, and supply from the city water works all water needed by them at the cost of pumping.

The Board of Trade, of Cedar Rapids, Iowa, want more manufacturing enterprises, although $2,500,000, is already invested there. The city is now in need of a furniture factory, paper mill, malleable iron works and many other industries.

At Middletown, Conn., W. & B. Douglass, manufacturers of pumps, hydraulic rams, hydrants and all kinds of water implements of this nature, are building an addition to their works 54x45 feet of brick and 3 stories high. Business is rushing with them and they are behind on their orders.

Rundle & Spence, manufacturers of brass and iron goods, 89 and 91 West Water street, Milwaukee, Wis., are making extensive improvements to their establishment, among which is the addition of a foundry and machine shop, with the latest improved machinery.—*Industrial World.*

Gromberg, Eggerman & Loser is the name of a new concern starting at Aurora, Ill, for the manufacture of a reaping machine. Their works are being erected and new machinery is going in place so that the establishment will be running by November 30th. They will also do general machine work.

The Betts Machine Co., Wilmington, Del., write us: We are still busy on ordered work and will be for two or three months to come, but we must confess to a falling off of trade as compared with this time last year. We trust this is but a temporary lull, and hope the new year will usher in another year of prosperity.

The Joliet Steel Company have closed a contract with Jacob Reese of Pittsburgh, by which they become a member of the "pool" to control the process of producing burnished steel shafting in the United States. The machinery will soon be finished and shipped to Joliet, Ill., and the manufacture of steel shafting made one of the Joliet Steel Company's specialties.

The Moore & Moss Foundry Company, manufacturers of architectural iron work, machine, sewer and chilled castings, Kansas City, Mo., are manufacturing chilled car wheels on a large scale. A large cupola, having a capacity of twenty tons per day, and an addition 45x60 feet to their foundry, soon to be built, will increase their working capacity 150 per cent.

R. A. Belden & Co., Danbury, Conn., write us that their business has nearly doubled in the last eighteen months. They are making a specialty of a 3 foot crank planer, also iron and steel drop forgings. They have just taken a contract for 15,000 Stillson's patent wrench and pipe tools, 10,000 crank balls for mowing machines and large quantities of other mowing machine parts.

Lodge, Barker & Co., Cincinnati, Ohio, write us: We are working all the men we can accommodate, having now 50 hands in our employment. We were awarded the medal for highest degree of merit on our engine lathes at the 10th Cincinnati Industrial Exposition, and are shipping as many East as we ship West, which we consider a very good sign of their merit. We are now ready to put on the market our new 26" screw cutting engine lathe. It is of new and elegant design and very powerful. We have already booked several orders for this lathe.

Progress Machine Works, Jackson & Tyler, Baltimore, Md., is a machine shop for the manufacture of tools and specialties in connection with their business as dealers in machinery, tools, and supplies. They are at present busy making emery grinders, gear-cutting attachments for lathes, work holders, speed motors and special work. They also manufacture set and cap screws, stud bolts, and any thing in screw line, to order. They are agents South for the Hot Polished Shafting, which is coming into use largely, and have just taken a large order for this shafting for a new cotton mill.

Warner & Swazey, Cleveland, O., have taken a contract to build an iron and steel dome 45 feet diameter for the University of Virginia. It will be set up at their works and completed, then taken apart, shipped to its destination and put in place. It will weigh about nine tons and it is warranted to revolve by a direct pressure of less than fifty pounds, by means of their improved running gear. The shutter is to be six feet wide and open three feet past the zenith. They are also busy building turrets and special machines for brass finishers. About thirty-five men are now employed and new tools are being added.

The large steam hammer or press at the Beatty Axe Works, Chester, Pa., A. B. Black, proprietor, is an immense piece of machinery, weighing 13 tons, and capable of making a hatchet, adze or broad-axe in a remarkably short space of time. Dies are used according to the shape of the tool desired. In these dies a piece of iron of the proper weight is put, and by intense pressure the iron is reduced to the desired shape. By an ingenious arrangement the iron is "steeled," that is, the required piece of steel is welded to it by pressure from four directions. It is again placed in the die and repressed and the "eye punched. A man then takes it, points it, and dresses it up for the market. This machine is expected to turn out twenty-four dozen hatchets per day, and a man could not make more than ten dozen in a week's work. It is also used for cutting iron, in which it is the means of saving much labor. A heavy knife is put upon the machine, and it will make a clean cut through a piece of cold iron 2¼ by 2⅛ inches. It is said there is no other press in this country like this one.

Machinists' and Engineers' Supplies.

NEW YORK, Nov. 9, 1882.

Orders for supplies continue small and business in this line is quiet. Novelties are scarce and there is little to record in the way of news. E. P. Bullard, proprietor of the Bridgeport Machine Tool Works, 14 Dey street, New York, has just issued a new circular and price list containing illustrated descriptions of new machine tools made at his works. Mr. Bullard has secured as manager of the manufacturing part of his business, the services of Jerome B. Secor, a gentleman of rare mechanical skill and ingenuity. A new system of gauges and appliances for duplication of parts has just been completed by him so that like parts of machines will interchange.

Iron and Metal Review.

The condition of the Pig Iron market has not changed materially since our last report.

We quote prices as follows: Foundry No. 1, $26 to $27. Foundry, No. 2, X, $23.50 to $24.50. Grey Forge, $20.50 to $21.50. The market for Foreign iron continues quiet but firm with sales small. We quote Coltness, $27.50; Glengarnock, $25; Gartsherrie, $26 to $26.50; Summerlee, $26.50; Carnbroe, $24.50; Eglinton, $23.50 to $24; Langloan, $26 to $26.50.

Copper is quiet at 18c. to 18¼c. Banca Tin 28c. Straits and Malacca 23¼c. to 23⅜c.; Billiton 25⅛c.; Australian 23c to 23¼c.; Spelter, Common Domestic, 5.25c. to 5.38c.; Refined, 8c. to 8¼c.; Silesian 5.30c. to 5.38½c.; Lead, 4.80c. to 4.85c; Refined, 4.90c.; Antimony, Hallets, 10⅞c.; Cooksons 12⅞c.; Nevada 12¼c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted situation as Lathe hand on fine machine work. Address, D. K., care AMERICAN MACHINIST.

Wanted—A permanent traveler to represent the Gardner Governor. Must be well posted. Address, R. W. Gardner, Quincy, Ill.

Mechanical draughtsman and superintendent with good practical experience, wants employment. X., care AMERICAN MACHINIST.

Wanted—Foreman for machine shop—about 25 hands—manufacturing engines and mill machinery. A thoroughly competent, pushing, practical man. Address, 6 Strachan Avenue. Toronto.

Wanted—Mechanical draughtsman with not less than three years' experience on marine and stationary engines, single man from 25 to 35 years of age preferred. Address, A. B., AMERICAN MACHINIST office.

Mechanical Engineer and Draughtsman desires engagement as Superintendent or Draughtsman. Practical experience in steam and general machinery, blast furnace and construction work. Address, "H," care AMERICAN MACHINIST.

Wanted—Nathan & Dreyfus, of New York, are in want of the services of several experienced salesmen with a practical knowledge of boilers and boiler-feeding appliances, to canvass for ther new Monitor Injectors and their other patent specialties. Address by letter, with full particulars as to qualifications, age, previous employment and references, as above.

Wanted—An active, energetic and competent practical machinist to take charge of a machine shop as foreman; class of work, the manufacture of wood-working machinery and general repairing. We want a thorough mechanic and one who understands taking charge of work and men. No others should apply. Must be active, industrious and sober. To such an one we offer good wages and prompt pay. References given and required. Address, Employer, No. 6 Franklin Avenue, Toledo, Ohio.

For sale—A Hittinger & Cook engine, 12x36, in good order. Apply at Hydraulic Works, VanBrunt street, South Brooklyn, New York.

Two Berryman Patent Feed Water Heaters.—One 36 inches diameter, 12 feet high, 9 inches exhaust; one 34 inches diameter, 9 feet high, 8 inches, exhaust. These heaters are only a short time in use, are in perfect order, and will be sold very cheap. Benj. F. Kelley, No. 20 Cortlandt St. N. Y.

TO PAYMASTERS. Belcher's Paymaster's Assistant shows, at one glance, the amount of men's wages for quarter, half, three-quarters and even hours at all the ruling rates per hour. For ex.: 56¾ hours at 23½c. shows in one amount, $13.24. Price $2.00 by mail or express, C. O. D. Send for circular with first-class references. Address

E. W. BELCHER,
Box 47, Glenwood, Mass.

E. G. FELTHOUSEN, BUFFALO, N. Y.
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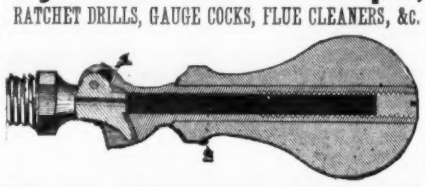

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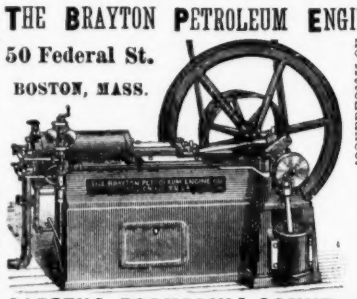

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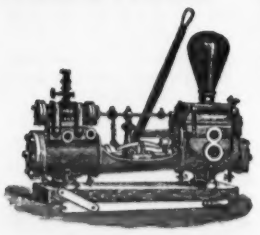

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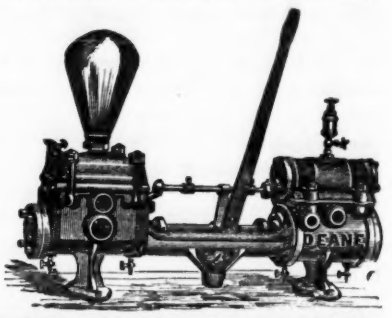

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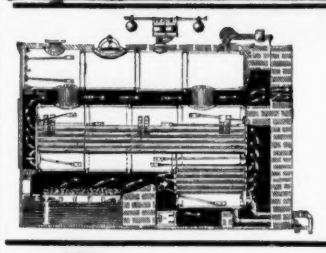

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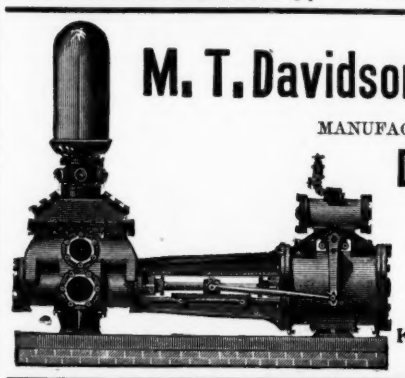

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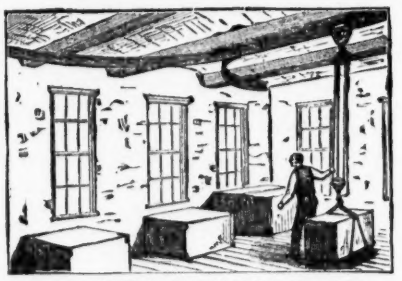

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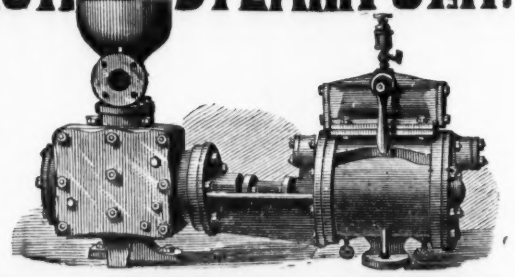

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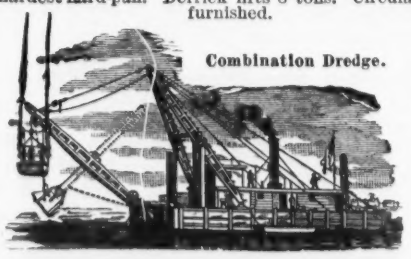

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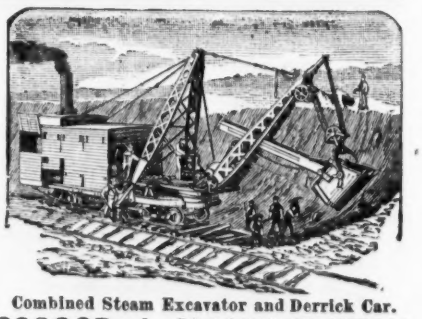

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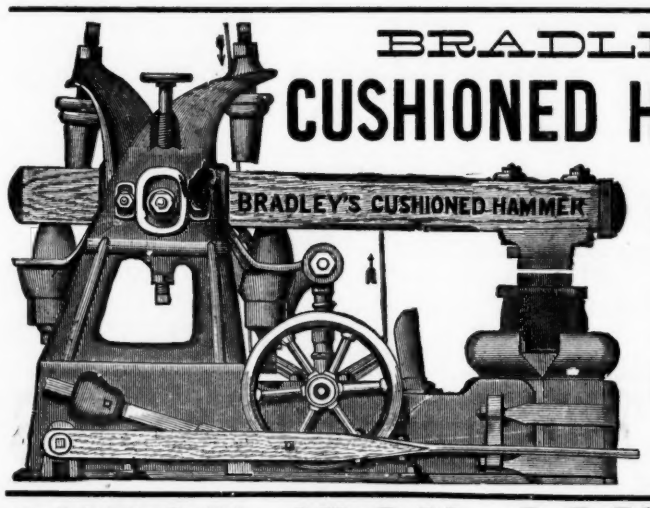

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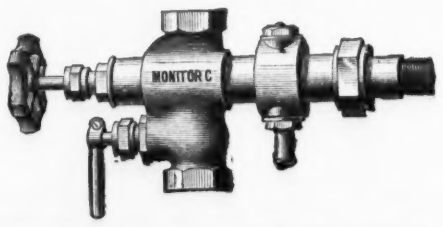

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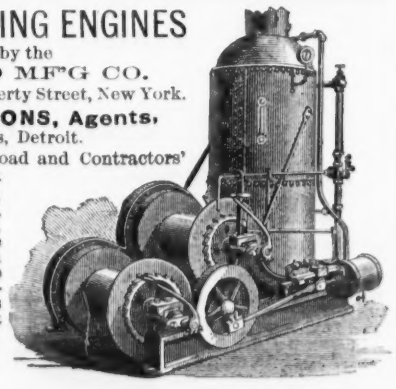

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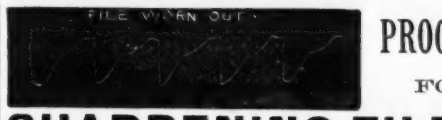

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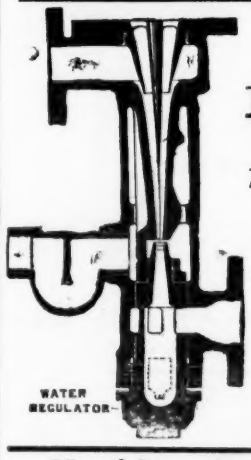

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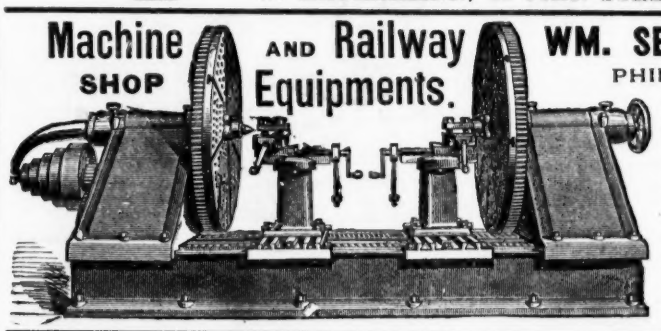

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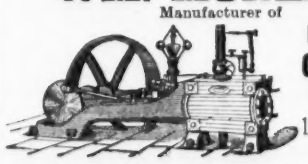

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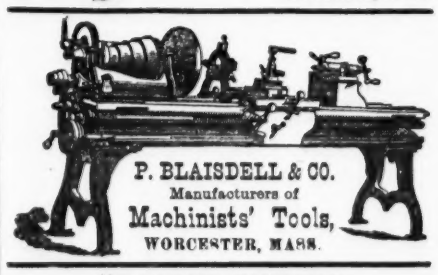

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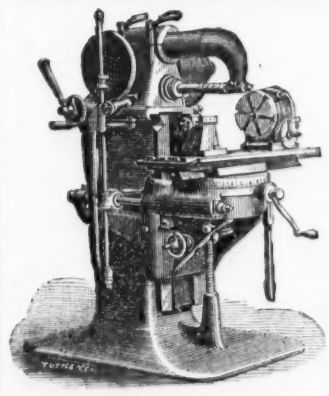

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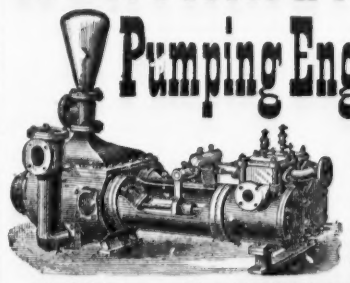

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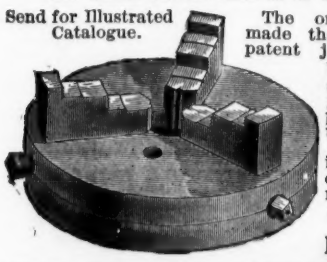

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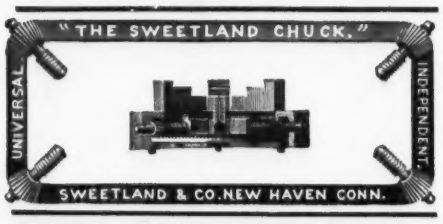

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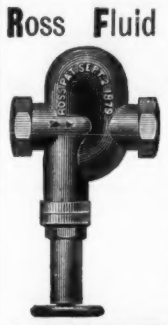

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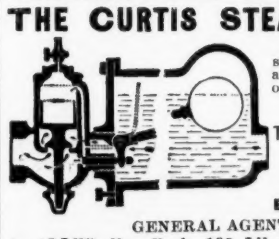

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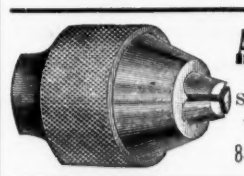

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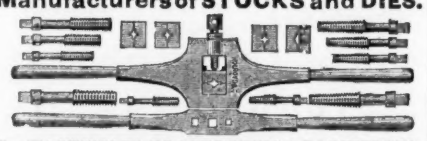

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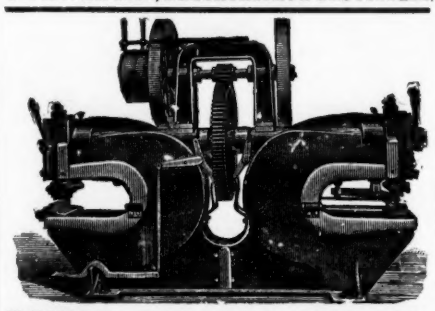

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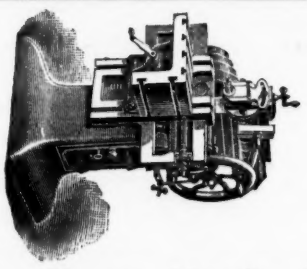

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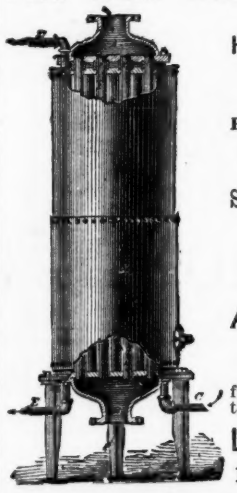

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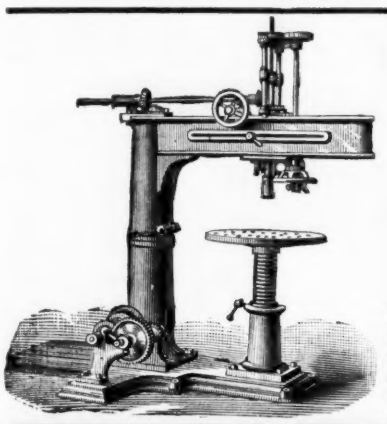

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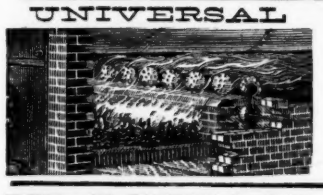

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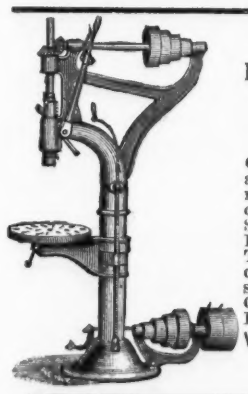

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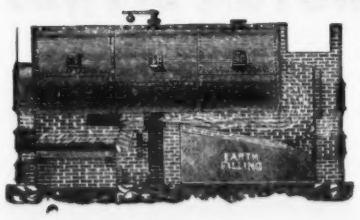

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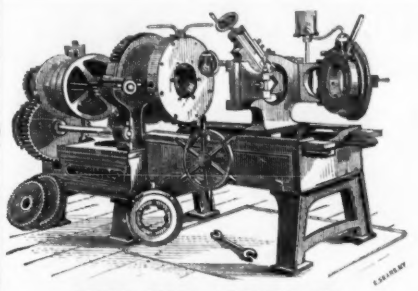

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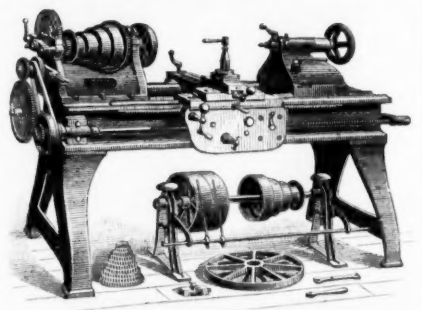

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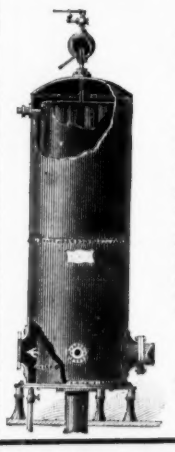

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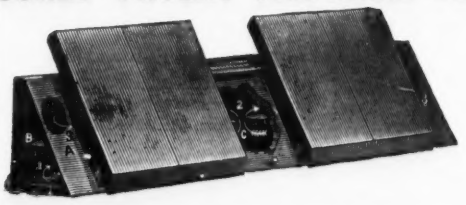

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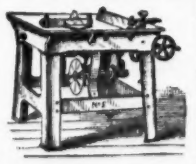

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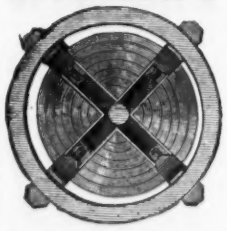

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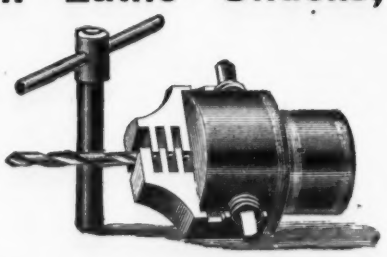

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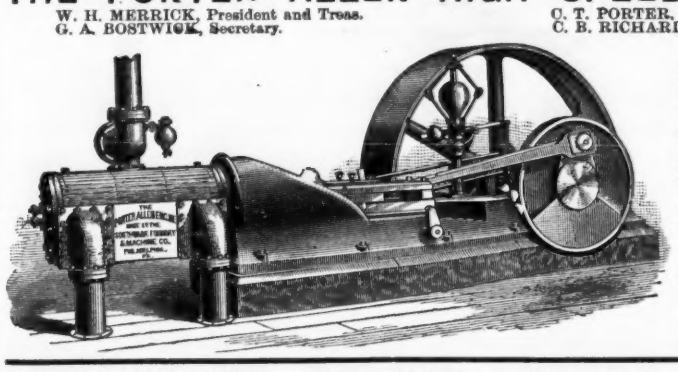

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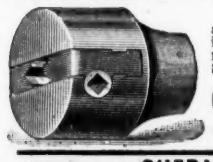

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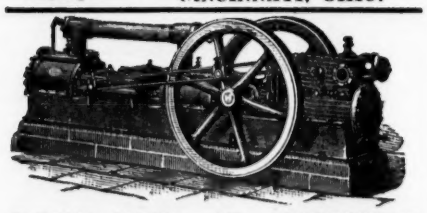

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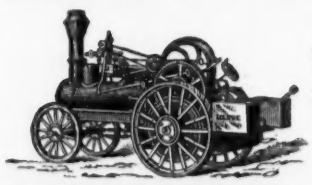

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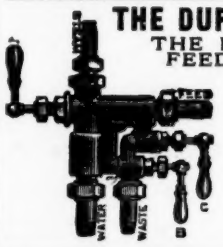
THE DUPLEX INJECTOR.

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. **Always** delivers water *hot* to the boiler. Will start when it is hot Will feed water through a heater. Manufactured and for sale by

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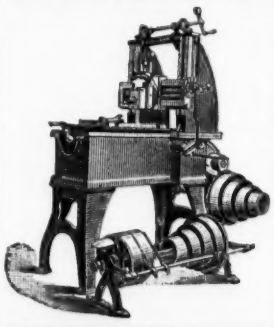

Planes 16 inches high and wide, and has 12 inch stroke. It has power, cross and angular down feed as shown in cut, or cross feed only, if desired.

Also, quick return motion and screw running whole length under bed.

It is self-oiling in its ways.

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For every class of Steam Engines, Steam Pumps, Vacuum Pans, &c.

Guaranteed to Save 20 to 25 per cent. of fuel, or gain 25 to 30 per cent. in power.

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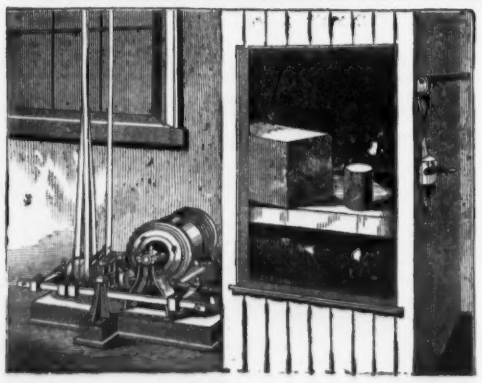

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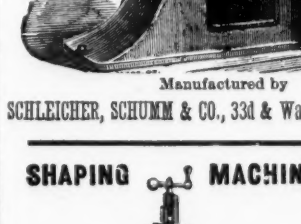

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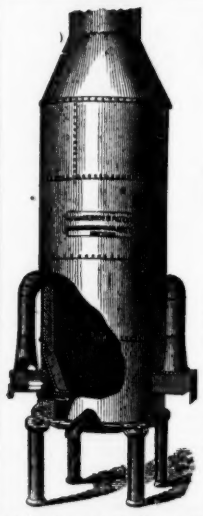
MAKER OF FIRST-CLASS



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Differs from all others in having a continuous tuyere. Blast enters fuel at all points, causing complete diffusion of air, and uniform temperature throughout the furnace. Melts 10 to 15 tons an hour with blast pressure required to melt 2 or 3 tons in an ordinary cupola. Gains largely in time, fuel and quality of casting.

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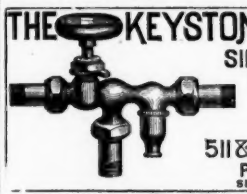

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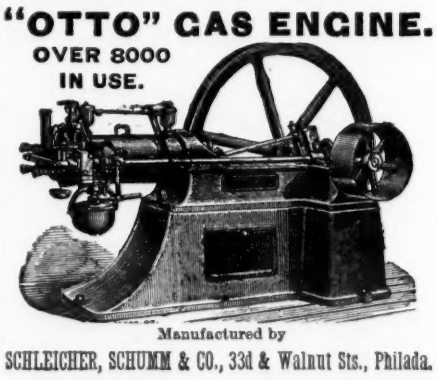

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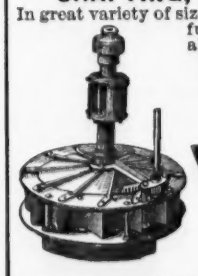

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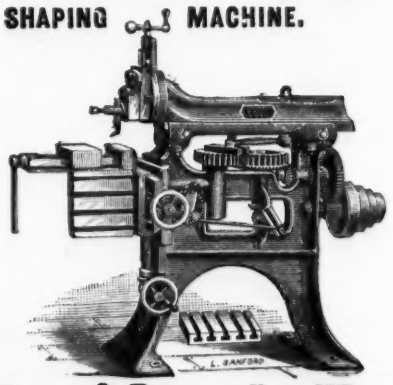

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Manufacturers of the New
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PLANERS, LATHES, SHAPERS, SLOTTERS, DRILL PRESSES,
Both double and single column, Bolt and Pipe Cutters, Keyseating Machines, Hydraulic and Sugar Estate Machinery, Shafting and Gearing, Boilers, & Heavy Hydraulic Oil Presses a specialty.
One 48" x 48" x 12 ft. Planer in stock.

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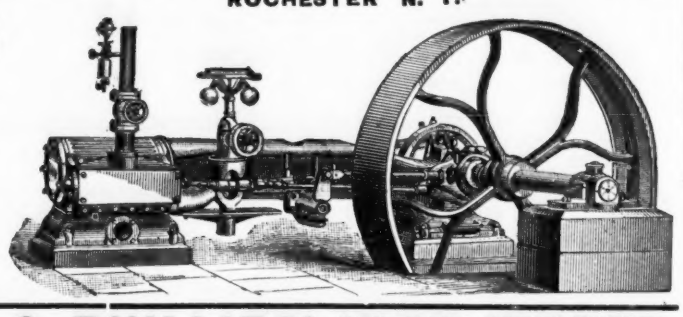

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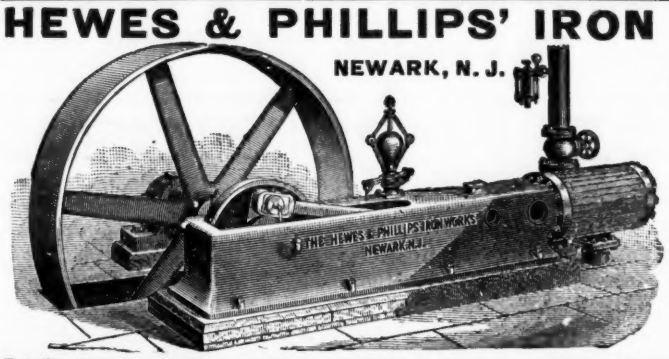

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Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

Tubular Boilers and Steam Fittings. Contracts taken for complete Motive Power Outfits.

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NEW IRON WORKING MACHINERY

On Hand or for Quick Delivery.
Write for prices and particulars.

ENGINE LATHES.

38 inch, triple-geared (bed to suit).			Fitchburg.
28 inch swing,		18 foot bed.	Fitchburg.
26 " "		18 "	Fitchburg.
24 " "	14 and 16	"	Fitchburg.
21 " "	12 and 14	"	Blaisdell.
20 " "		14 "	Fitchburg.
20 " "		12 "	Fifield.
19 " "	10 and 12	"	Gray.
18 " "	10 and 12	"	Blaisdell.
17 " "		6 "	Johnson.
16 " "	6 and 8	"	Fitchburg.
14 " "	6 and 8	"	Fitchburg.
13 " "		8 "	Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
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36 inch x 36 inch x 9 ft., planer. 2d hand, good order.	Wheeler.
26 inch x 24 inch x 6 and 7 ft. planer,	Wheeler.
22 inch x 20 inch x 4 ft. planer,	Wheeler.
18 inch x 18 inch x 3 foot planer,	Gould.
10 inch stroke shaper,	Fitchburg.
15 inch stroke crank planer,	Blaisdell.
10 inch stroke shaper,	Gould· Fitchburg·
12 inch stroke shaper,	
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48 inch radial drill, self-feed, double gearing slotted and planed bed.	Betts.
30 inch, back-geared, automatic.	Prentice.
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19 inch, " "	Blaisdell.
18 inch, " "	Blaisdell & Fitchburg.

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American Tool Machine Co's.

No. 2 Cabinet Turret Lathes, 6 ft. bed, 18 in. swing.
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Sq. Arbor Fox Lathe, Gage.

2, 3, and 4 spindle drills,	Garvin.
15 inch swing, 5 foot bed, Fox Lathe,	Gage.
No. 2 (¼-1¼) Bolt Cuttters,	Merrimans.
Power and Hand Millers,	Garvin.
12 inch slotter (swing 56 inch),	Hewes & Phillips.

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SPECIALTIES.

Extra Heavy Bridgeport 16 in. Swing Engine Lathes.
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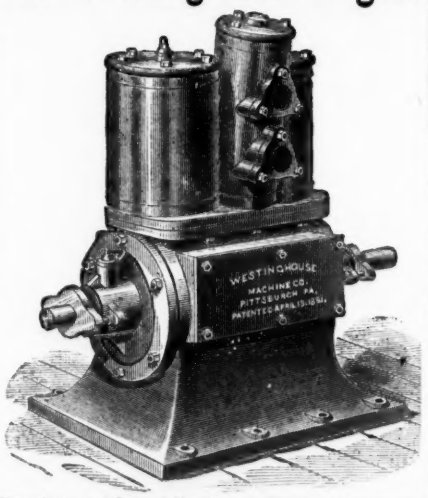
The Westinghouse Engine



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One Gleason, Triple Geared, Screw-Cutting Engine Lathe, 40 inch swing, 16 foot bed.

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One Special Shafting Lathe, 28 inch swing, 25 foot bed, to take 20 feet between centers.

One Special Shafting Lathe, 26 inch swing, 25½ foot bed, to take 20 feet between centers.

PLANERS.

One Pond Planer, 26 in. x 26 in. x 8 ft. One Hendy Planer, 26 in. x 26 in. x 6 ft. One Gleason Planer, 36 in. x 36 in. x 8 ft.

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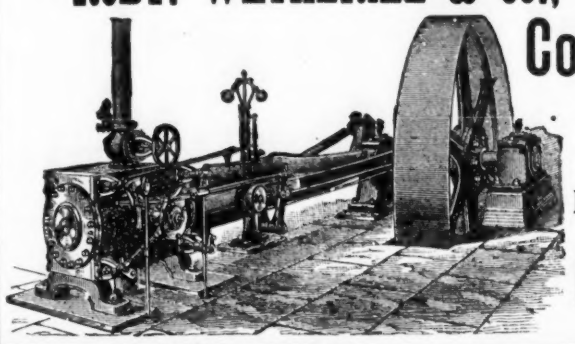

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One 14 " 36 " In two weeks.

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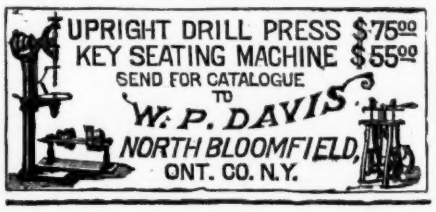

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Swivel Head Engine Lathes,

(18 and 26 in. from new patterns)

GEORGE GAGE, WATERFORD, N. Y.

New & Second-Hand Machinery.

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1	Engine Lathe,	14 in. x 5, 6 & 7 ft.	Grant & Bogert.
1	" "	26 in. x 12 ft.	Grant & Bogert. [New.
1	" "	22 in. x 14 ft.	" " New.
1	" "	36 in. x 12, 17 ft.	New.
1	" "	42 in. x 14 ft.	New.
1	" "	32 in. x 8 ft.	" "
1	" "	21 in. x 7 ft.	" " Pond.
1	" "	14 in. x 6 ft.	Star Tool Co. New.
1	" "	15 in. x 6 ft.	"
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1	" "	16 in. x6, 7 & 8 ft.	Ames. "
1	" "	18 in. x8 & 10 ft.	Lodge & Barker"
1	" "	24 in. x 12 ft.	Perkins. "
1	" "	20 in. x 12 ft.	Fifield. New.
1	" "	28 in. x 16 ft.	New. Fifield.
1	" "	11 in. x 4 ft. & 5 ft.	Prentiss. New.
1	" "	11 in. x 4 ft.	New.
1	" "	12 in. x 5 ft.	Young. New.
1	Plain Engine Lathe,	16 in. x 4 ft.	"
1	" "	15 in. x 4 ft.	New.
1	Fox Lathe,	15 in. x 5 ft.	Am. Tool & Machine Co.
1	15 in. x 4 ft.	Turret Lathe.	Lodge & Barker.
1	Fox Turret Lathe,	16 in. x 6 ft.	Lodge & Barker. New.
1	Planer,	38 in. x 38 in. x 8 ft.	New.
1	"	36 in. x 36 in. x 18 ft.	"
1	"	36 in. x 36 in. x 6 ft.	Good order.
1	"	16 in. x 14 in. x 3½ ft.	New.
1	"	22 in. x 20 in. x 5 ft.	"
1	"	24 in. x 24 in. x 6 ft.	Hendey. new
1	"	26 in. x 26 in. x 7 ft.	
1	"	20 in. x 20 in. x 4 ft.	Good order.
1	"	16 in. Turn Table Drill.	New.
1	16 in. Upright Drill.		"
1	20 in. Upright Drill.		Prentiss. "
1	24 in.	" "	Prentiss. "
1	30 in.	" "	" "
1	25 in. swing B.G. & S.F. Drill.		Blaisdell. "
1	28 in.	" "	" " "
1	15 in. Shaper.		Gould & Eberhardt. "
1	10 in Shaper.		Gould & Eberhardt. New.
1	15 in. Shaper.		Hendey. "
1	24 in. Shaper.		Hendey. "
1	9 in. Shaper		Hewes & Phillips. "

Full assortment Milling Machines, Spindle Drills, &c., of Garvin's. New.

1 Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New.
2 No. 2 Lincoln Millers. Good order
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MACHINERY.

42	inch Swing,	16 foot	Bed, Engine	Lathe.	New.
40	"	14	"	"	"
36	"	18x12	"	"	"
32	"	9	"	"	"
30	"	18-16-14&12 ft. beds		"	"
24	"	12 foot Bed.		"	"
20	"	6&10	"	"	"
18	"	8&10	"	"	"
17	"	6	"	"	"
16	"	6&8	"	"	"

Large list of 2d-Hand Lathes. Various sizes & lengths.

38	inch x	38	inch x	12	foot	Iron Planer.	New.
38	"	38	"	8	"	"	"
36	"	36	"	11	"	"	"
36	"	36	"	9	"	"	"
32	"	32	"	9	"	"	"
27	"	27	"	7	"	"	"

and other sizes.
Shapers, Drills, Bor'g Mills, Cutting-off Machines, &c.
Send for Circular of other tools.

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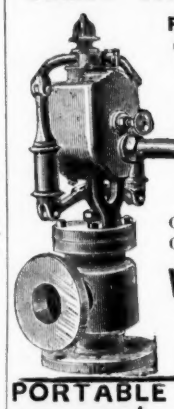

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Guaranteed to accurately regulate all classes of engines.

Illustrated and descriptive Catalogue sent on application. Correspondence solicited.

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Sole Manufacturers,

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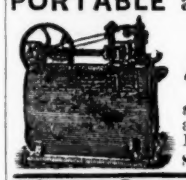

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5 to 25 H. P. Parts duplicate and interchangeable, specially adapted to run Electric Light Machinery. Send for Circular.

SKINNER & WOOD, Erie, Pa.

New & Second-Hand MACHINERY.

Nov. 8, 1882.

The following New and Improved Machinists Tools are part of what we have for early delivery

1	60 in.	swing	24 ft.	bed.	Engine Lathe.	Dec. 1.
1	42 in.	"	20 ft.	"	" " "	" 1.
1	36 in.	"	18 ft.	"	" " "	" 15.
1	36 in.	"	14 ft.	"	" " "	" 15.

The following on hand:

1 30 in. Swing, 18 ft. bed. New Engine Lathe.
1 30 in. " 16 ft. " " " "
1 30 in. " 14 ft. " " " "
1 30 in. " 12½ ft. "
1 26 in. swing, 14 ft. bed.
1 32 in. x 8 ft. Planers. New.
2 12 in. stroke Slotting Machines. New. Oct. 10.
1 42 in. swing, 16 ft. bed, New Engine Lathe.
1 New Corliss Engine. 12" x 36". Complete.
1 22 in. " 12 ft. " "
4 18 in. " 8 ft. " " "
1 17 in. " 10 ft. " "
5 15 in. " 6 ft. " " "
1 12 in. swing, 6 ft. Hand Lathe. New.
1 10 in. " 4½ ft. Bed Hand Lathe. New.
1 38 in. x 10 ft. Planer. New.
1 38 in. x 12 ft. Planer. New.
2 30 in. x 8 ft. Planers. New.
2 22 in. x 4 ft. Planer. New.
2 38 in. Swing Upright Drills. B. G. & S. F. New.
1 23 in. Drill. B. G. & S. F. New.
1 22 in. " Upright Drill. B. G. S. F. New.
1 23 in. " Plain.
3 20 in. " "
1 18 in. Bench Drill.
1 4 spindle Drill. New.
1 3 " " "
2 4 " " Second-hand.
1 Wall Drill, heavy. Second-hand. 60 in
2 12 in. Shapers. New.
2 15 in. " "
2 12 in. stroke Shapers, traveling head, 40 in. traverse double tables. New.
3 Wood's Patent Bolt Cutting Machines to cut from ½ in to 2 in inclusive. New.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 No. 1 Screw Machine. Brown & Sharpe. 2d-hand
1 Screw Head Slotter. Second-hand.
2 Second-hand Profiling Machines
2 4½ in Hyde's Patent Centering Machines. New.
1 Emery Grinder, 2d-hand. for 10 in. Wheels.
1 Bolt Pointing Machine. Second-hand.
1 Double Nut Tapper. New Horizontal.
2 Double-Acting Presses, No. 3, nearly new.
1 No. 00 Fowler Press.
4 Single-Acting Presses, for power, "
100 Foot Presses, nearly new.
2 Small Power Punching Presses. Second hand.
1 Foot Punch, with bench. New.
1 Lot Pistol Machinery. Second-hand.
Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.
Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in stock.

The George Place Machinery Company
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BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.

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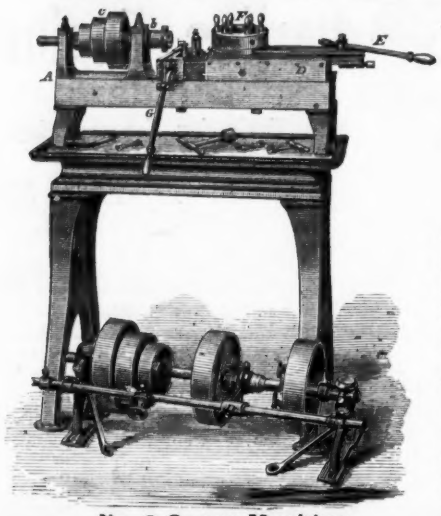
MACHINERY AND TOOLS.



No. 3 Screw Machine.

This machine is designed for making such screws as are used by manufacturers of Sewing Machines, and Fire Arms and the smaller kinds of screws used by machinists. It can be used also for tapping and facing small nuts, making washers, pins, etc. Size of hole through spindle, 5/8 inch; size of hole in revolving head, 11/16 inch; length that can be milled, 3½ inches. Friction pulleys on countershaft are 10 inches diameter, and 3¼ inches wide. Countershaft should run 270 turns per minute. Weight of machine prepared for shipment, about 750 lbs.

Special Pulley Machinery.

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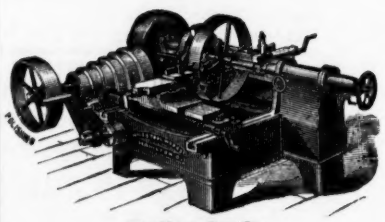
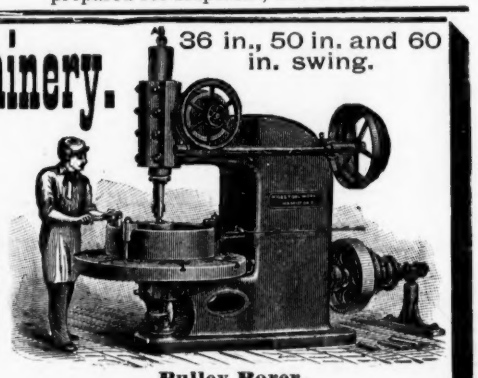


Pulley Lathe.



Pulley Borer.

REFERENCES.

Crane Bros. Mfg. Co., Chicago, Ills.; E. P. Allis & Co., Milwaukee, Wis.; Buckeye Engine Co., Salem, Ohio; Geiser Manufg. Co., Waynesboro, Pa.; Frick & Co., Waynesboro, Pa.; Pray Manufg. Co., Minneapolis, Minn.; North Star Iron Works, Minneapolis, Minn.; Grainger & Co., Louisville, Ky.; Blymyer Mfg. Co., Cincinnati, O.; Simpson & Gault, Cincinnati, O.; Poole & Hunt, Baltimore, Md.; Jones & Laughlins, Pittsburgh, Pa.; Sinker, Davis & Co., Indianapolis, Ind.; M. C. Bullock, Chicago, Ills.; W. McGregor & Co., Chicago, Ills.

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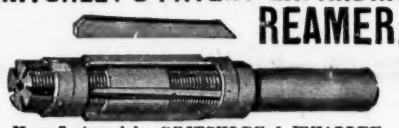

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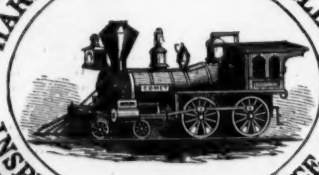

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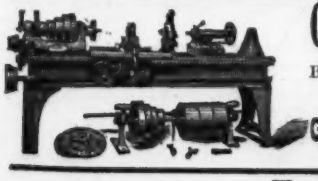

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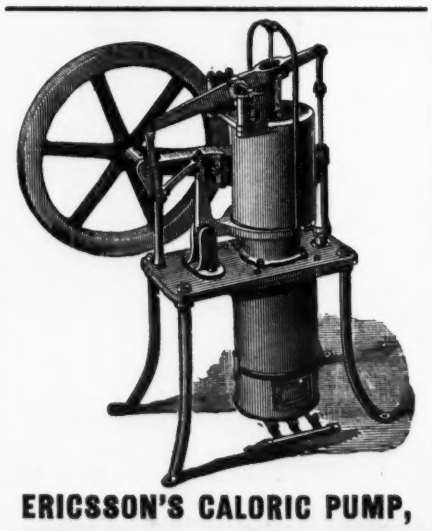

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